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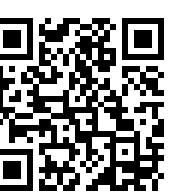

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THE ORGANIZATION AND TRAINING OF THE R.E. FORTRESS SERVICE.

By COLONEL W. BAKER BROWN, LATE R.E.

IN the new edition of *Engineer Training*, published in 1912, a very valuable advance has been made in defining the duties of Engineers in war, and in the instructions for training to fit all ranks to carry out those duties.

But it is noticeable that in Part II. which is headed " The Employment of Engineers in War," the only phase of war which is dealt with is that of an expeditionary force acting in an unknown country. I am far from saying that this is not a most important part of our duties, and I would go further and say that in many respects it is the most difficult, as the need of rapid decision and execution with a minimum of men and materials demands a very high standard of individual technical knowledge and much previous training before a unit can become efficient.

On the other hand the fact remains that the largest of the groups of units, into which the Corps is now divided, is the group which provides for the Engineer duties in fortresses. This group comprises some 30 companies, and there are affiliated to it a large number of Territorial and local forces who look to the R.E. for instruction and example in carrying out their work. It seems therefore desirable to lay down some rules for their organization and employment.

Having recently completed a tour of four years as a C.R.E. in one of our largest fortresses abroad, I may be allowed to indicate briefly what I consider the best methods of obtaining the required standard of training and the difficulties likely to be met with.

Interdependence of Field and Fortress Duties.—Much of the work in fortresses is of a technical nature, requiring a large proportion of specialized workers who must be highly trained in their particular branch. At the same time, and this is a cardinal factor of the organization of the R.E., all our actual experience of war has shown that in addition to the call for the skilled services of the field units allotted in peace to the various commands which compose our expeditionary force, there will be demands for many other forms of skilled Engineer assistance at the base, on the lines of communications, in siege works, or in the preparation of semi-permanent defences. And such demands have always been met in the past by

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drawing largely on the fortress service, not only by units but by individuals.

It is thus essential, and this point is emphasized in *Engineer Training*, that the whole of the R.E. fortress service should be trained in Engineer duties in the field, in addition to their special training in fortress duties.

DUTIES OF R.E. IN A FORTRESS.

Work to be Done in Peace.—1. Erection, maintenance and running of defence electric lights, both fixed and mobile.

2. Erection, maintenance and working of the military telephone system except those portions which are maintained by the Post Office in Great Britain and Ireland.

3. Construction and maintenance of fortifications and permanent entrenchments, including living accommodation for their garrisons; military roads; magazines and storehouses; sites for camps.

4. Maintenance, and in some cases construction, of barracks and other military buildings.

5. Preparation of detailed schemes for strengthening the defences on the outbreak of war.

6. Assistance in the training of other troops, such as running electric lights for artillery training or advice on entrenchments for infantry.

Work to be Done in War.—This is practically a continuation of the peace duties, on a larger and more strenuous scale. Thus :—

1. Electric lights will be run all night for many nights in succession.

2. Additional telephone lines must be run and offices opened to link up the extra defences to be constructed under Subhead 5. Telephone exchanges must be manned night and day.

3. Forts must be prepared for war; musketry parapets completed; obstacles erected or improved; dressing stations arranged; reserve water supply and adequate sanitary services provided for the war garrisons.

4. As barracks will in many cases continue to be occupied, their maintenance, especially of the water and sanitary services, must be continued as in peace. Some of the barracks may have to be converted into hospitals.

5. The schemes for strengthening the defences must be put into effect; entrenchments constructed; as these may have to be occupied for some weeks, special attention must be paid to surface drainage, water storage and sanitation, and in many cases the shelters in works may develop into semi-permanent buildings of iron and concrete.

Works.—I think all Engineer officers will agree that the above summary fairly represents the necessary duties of Engineers in

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fortresses except as regards the administrative duties connected with barrack construction and maintenance. There are still some officers who look on such employment as a corvée or forced labour, put on to the Corps in order to make a financial saving on the estimates. I do not think that a detailed consideration of the case will bear out this opinion.

The arguments for the inclusion of barrack work among the duties of the Corps may be stated as follows :—

1. The work involved in the construction of fortifications is admittedly work which should be done by military engineers, but this work involves questions of living accommodation for the garrisons and this touches all the engineering problems which are involved in barrack construction and maintenance.

2. The work required from Engineers on the line of communications, or in rear of the field army, and much of the work with the army itself, is very similar in kind and even in degree to the work done under the barrack estimates. *Engineer Training*, Sect. 96, para. 5 (ii.), (iii.), (iv.) and (v.), Sect. 98, para. 1 (iii.), Sect. 102, para. 1 (i.), (ii.), (iv.) and (v.), Sect. 107, para. 1 (ii.), (iii)., (iv.) and (v.) and Sect. 108 all refer to Engineer works of the class I refer to.

3. For the reasons given in *Engineer Training*, para. 11 (i.), it is rarely possible to actually practice such duties during manœuvres. On the other hand the supervision of barrack work gives invaluable practice to our officers in dealing with the supply of stores, supervision of military or civil labour, or work with contractors, and encourages habits of foresight and economical use of men and material. All of this forms excellent training for our duties in war. *Engineer Training* in many places lays stress on the necessity of preliminary preparation of plans, careful reconnaissance and deliberate collection of stores. Employment on works gives practice in all these points.

4. In the case of N.C.O.'s and men, "works" give excellent opportunities for employing men at their trades as laid down in *Engineer Training*, Sect. 8 (ii.).

Some officers while admitting the above arguments are of opinion that sufficient employment on works could be obtained by limiting the duties of the military engineers to the charge of fortifications, military roads, and other works of a distinctly military nature, leaving barracks to be looked after by a civil department. But quite apart from the inconvenience of having two Engineer organizations in each fortress, I am decidedly of opinion that, at stations abroad at least, such an arrangement would not provide full employment in peace for the officers and men of the military engineer service who must be maintained in readiness for war, and would not give an adequate training in certain trades and branches of engineering.

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Indeed I would go further and say that if by any chance barrack services were removed from the R.E. we should find our technical efficiency fall off so much, that we should ask permission to revert to the present system.

All previous experience shows that if a separate department was established for the execution of barrack works, it would almost at once go through two stages. First, there would be a demand to give the department military rank and position, so as to give it a proper status with the officers and men occupying the barracks. Second, in all fortresses, the staff for barrack works would be required to assist the military engineers in the first preparation of the fortress for defence when mobilization is ordered; this would involve a demand for a modified form of military training for this department. The final result would be the production of a military engineering organization, much as we have it at present.

To sum up, my conclusion is that our employment on works is an essential portion of our training as military engineers.

But the employment on barrack work should not be such as to exclude or unduly limit other forms of training, and to ensure this certain conditions must be fulfilled which I may state in order:—

1. The number of R.E. allotted to a fortress must be calculated in the first place on the duties which have to be performed in war after allowing for the fullest possible use of any local forces which can be raised.

2. As this number will never suffice to carry out all the barrack works, it must be supplemented by civilians directly engaged to work with the R.E. or by contract labour.

3. In arranging the work to be done by R.E. or civilian labour, the training of the R.E. must be considered. For instance, it is seldom wise to detail an R.E. for permanent charge of a pumping engine which has to work continuously throughout the year as that would interfere with other forms of training. On the other hand an R.E. might quite usefully be detailed for temporary charge during the sickness or absence of the civilian. Again the excessive employment of N.C.O.'s and sappers on purely clerical duties is likely to adversely affect their training as tradesmen.

4. The whole works organization should be on a military basis, following as closely as possible the probable war distribution of the R.E.

5. The charge of engineer works must be considered as an important administrative duty, demanding from all ranks a high standard of efficiency, care and zeal in execution, and involving long working hours.

6. The carrying out of works services is subject to certain limitations which impose greater strain on the staff for works at certain times of the year. Such times should not be selected for carrying out other forms of training such as musketry and fieldworks.

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7. It is seldom possible to entirely stop works services so that at all times of the year some officers and men must be available to supervise works.

These last two considerations must be kept in mind not only by R.E. officers but by officers of the General Staff when arranging training programmes.

Establishment and Organization.

The distribution and organization of the R.E. fortress service when it was rearranged in 1905, were specially adjusted to comply with the above considerations, as will be seen if we consider the details.

Establishments.—The number of officers, W.O., N.C.O. and men allotted to any fortress is now based almost entirely on the minimum required in war, after making allowance for all possible assistance from reservists, territorial or local forces who would join a fortress on mobilization. The effect is, that in our home defences the peace establishment of R.E. (permanent forces) is comparatively small and in fact provides for little more than a skeleton round which the engineer organization for war can be built up. But at most foreign stations the local forces are either small in numbers or deficient in quality, so that the number of permanent R.E. approximates to the total of the war garrison.

This difference between home and foreign establishments has very considerable effect on the system of training to be followed.

Although all the N.C.O. and men in the fortress service are on one roster for promotion and drafting, they comprise two distinct classes, those specially trained in " coast defence " duties and others not so trained who are called the *personnel* for " works." The first class, who are the successors of the old Submarine Mining Service, are specially trained in working the electric lights and telephones and include a large number of men with high qualifications as tradesmen. The others are men of general trades, identical in training and qualifications with the *personnel* of the R.E. field companies except that they have no experience of mounted duties.

The works *personnel* comprise men of general trades in a proportion which is fairly uniform for all stations with a margin of about 10 per cent. of "unallotted" trades to allow of the provision of any special trades which may be required to suit the needs of any particular station; trades which come under this heading are printers, surveyors, sawyers, extra masons in a stone country and so on. The numbers of the works *personnel* vary with the size and importance of the fortress, but generally they should bear a definite proportion to the infantry garrison. Our present proportion abroad is between three and four R.E. to every 100 infantry.

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The coast defence *personnel* in addition to the specialists—electricians, engine drivers, telephonists and instrument repairers—includes a number of men of general trades with a margin of "unallotted." All are, however, trained in "coast defence" duties, that is the simpler duties connected with lights and telephones, and those of general trades are employed in war in the less important duties. The establishment of coast defence *personnel* depends on the actual number of lights and telephones in each fortress.

Organization of Military Units.—At the same time as the establishments were brought into line with war requirements, certain new principles of the organization of R.E. work were introduced. Taking the military organization first, the changes consisted in

1. Forming the R.E. in a command into a few "large companies."
2. Posting as far as possible all R.E. officers under the rank of lieut.-colonel to companies.

Under the previous organization the R.E. for mines and lights had been very completely localized, but the R.E. works service was still organized in small companies, generally of a strength of 93 N.C.O. and men,* commanded by a captain with two subalterns. Any other R.E. officers in a fortress, including all majors, were not posted to a company and took only a small part in the military training of the command.

Under the new organization there is in a typical fortress of moderate size only one R.E. unit to which all officers and men belong. But when the numbers exceed a total of about 200, one unit would be too clumsy and then two units are formed, one for the N.C.O. and men trained in coast defence duties and one for the remainder. This latter form of organization exists at Malta and Hong Kong abroad, and Portsmouth and Plymouth at home. Gibraltar is an exception as it retains its old organization into four small companies, two for coast defence duties and two for works *personnel*. This exception was made mainly for sentimental reasons. In some commands at home, the R.E. at several small fortresses in the same command are grouped to form one unit.

The advantages of this organization into large companies may be stated as :—

1. Better training for all officers, especially of the rank of major.
2. Reduction of company staffs, fewer clothing accounts, etc.
3. Facility of transferring men within a command from one duty to another.
4. More equal appointment to lance rank and promotion of N.C.O. This is often unsatisfactory when units are very small.

It must be observed that this organization involves one peculiarity

* I have never found out how this figure of 93 was arrived at. It was most probably a subdivision of some older organization.

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in that the " unit " is an administrative entity only and *not* a fighting organism. In war the R.E. in a fortress necessarily work in a number of detachments of various size, while even in peace it is seldom possible to keep all the R.E. in one barracks, as detachments must be placed in the outlying portions of a fortress for the care of electric lights or for works.

It follows from this that there is seldom any advantage in assembling the whole of one company for training in its war duties, as such duties can be equally well practised by portions of a unit such as a half-company, section, or group of detachments, subject to certain conditions as regards numbers which I have discussed later on.

Command of Companies.—One of the objections urged against the system of large companies is that the major commanding will be so overwhelmed with the details of the company that he will have no time for other work. The answer to this lies in a proper devolution of responsibility as to which I have found some doubt to exist.

Speaking generally the whole military organization depends on a devolution of responsibility from the C.-in-C. downwards, and each link in the chain acts under the authority deputed to him by his immediate superior. Some of the duties to be thus deputed are laid down in regulations, but others are left to the discretion of individuals. There is then no reason why the major should personally superintend all details, thus, he can allot the charge of clothing to one officer, that of the pay accounts to another and so on, retaining only general supervision and such a devolution would be entirely in accord with military principles.

The application of the principle depends on local conditions ; it will be best illustrated by a description of the actual distribution of responsibility as it was worked out at Malta. At this station there are two large companies each commanded by a major. The conditions of work and the size of the available barracks made it necessary to make large detachments from both companies, and to station these detachments in three outlying divisions. The headquarters and about half of each company were stationed together in a central position. These half-companies at headquarters and the three detachments were each placed under the command of a captain and all five captains were given full responsibility for the command and local administration of their half-company or detachment. In addition the captains at headquarters were placed in charge of the pay accounts, clothing and equipment of their respective companies. The two majors had each important works duties and retained under their immediate control such general questions as the distribution of N.C.O. and men between headquarters and detachments, confidential reports, training and reports on training, and any question affecting their companies which had to be referred

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to higher authority. They also shared the barrack duties performed by the senior major of an infantry battalion.

It will be seen that under this system the captain's command was the local unit for all purposes and was treated as the unit in arranging training programmes and on ceremonial parades.

Malta is of course an exceptionally large station, but I commend to the notice of all officers serving in a unit, either in peace or war, which is large enough to have a major and a captain, the principle that the major should carry out what I may call the "General Staff" side of the duties such as training and technical work, delegating to his captain the "administrative" duties, such as pay, food, clothing, etc.

Establishment for Engineer Services.—So far I have not referred to the military portion of the Establishment for Engineer Services. This consists of a group of W.O. and senior N.C.O. selected for special technical duty and subdivided into four main classes (1) clerks and draughtsmen, (2) storekeepers, (3) mechanists, (4) foremen of works.

The first two classes require no comment; they will be fully employed in time of war on the same duties as in peace. The position of mechanists also is fairly well defined, they have definite duties in peace and war and they take part in all the technical work and training of the R.E. according to their qualifications in charge of groups of lights, engines or telephones.

A change of organization was made about 1905 in the amalgamation of various separate groups of mechanists, so as to form one single group for all electrical duties and another group for all machinery duties. Thus an electrician mechanist should be able to supervise any electrical work whether connected with defence lights, barrack lighting, electric power, or telephones, while a machinery mechanist should be able to erect and look after any class of machinery which is likely to be met with in R.E. charge. For instance, it should no longer be necessary, as was done in the past, to erect defence engines by a special machinery branch and then hand them over to be worked by the officers and mechanists in charge of the defence electric lights. This change makes it easier to detail mechanists to divisions.

But while the position of mechanists in war is thus clearly defined, the position of foremen of works is not. Most officers, I find, consider these as essentially a part of the peace organization only and look on a foreman of works as an individual with an extraordinary knowledge of the schedule, whose primary duty is to engage in a perennial battle with the triennial and other contractors. They therefore assume that the foremen will continue in war their special peace duties. Foremen of works thus receive no military form of training and are hardly taken into account in defence schemes. Possibly one reason for this is that they are as a class decidedly

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overworked, so that any idea of employing them on military duties has dropped.

But on the other hand, foremen of works do perform considerable military work in peace time in the construction of fortifications, military roads, and semi-permanent defences on the land fronts. Also they have very considerable technical knowledge of the strength of materials and experience of the supervision of labour. It seems obviously desirable to use this knowledge both in the supervision of work in war and in teaching junior ranks how to make the best use of material.

I am certain also that with the field army there will be a great demand for the services of this valuable class, on the line of communications, at sieges and whenever large works, such as hutting, the preparation of a defensive position, or the repair of a large bridge, have to be undertaken for the field army.

I suggest therefore that all foremen of works should be given some form of military training, such as by attaching them every second or third year to a company while going through a course of fieldworks, but this is only possible if some relaxation can be made in their works duties.

The command of this establishment is often a difficult point and in many places it is still customary to put them under the command of a special officer and to keep separate pay lists, clothing accounts, etc., for this staff. Not only do these little accounts give an amount of trouble quite out of proportion to the numbers involved, but this arrangement establishes a line of demarcation between this staff and the units which it is very desirable to avoid. The best solution in my opinion, and one which I have carried into practice at two foreign stations, is to attach the members of this staff to the company with which they generally work and live. They are then looked after as an integral part of the unit, separate accounts are saved and their position as a definite part of the military organization is emphasized.

Organization for Works.—The organization for works is a very large question, and I only propose to deal with it here so far as it bears on the military organization and training of the R.E.

The principal change introduced into the works organization in 1905 was in the formation of what I may call "Large Divisions." Prior to this date the custom had been to make as many divisions as there were officers, and I believe there were at one time in Malta as many as twelve divisions. It was of course impossible under such an organization to allot a proper office staff to each division, and I have known cases under the old system where three division officers shared one clerk, while I had personal experience of an instance where three division officers shared the services of one foreman of works. Under the old system there was also the

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absurdity that majors and subalterns were often treated as interchangeable for division purposes.

Under the system of "Large Divisions," each division is in charge of a senior officer—major or captain—with one or more subalterns as assistants, and each has a complete organization of office staff and of foremen of works, and mechanists for the work of the division. This organization also fits in with the military organization outlined above, as to each division there can be allotted a detachment (or local unit) which will be commanded by the division officer.

Further, the principle should be enforced that, in addition to the military command and building work, the division officer should be held responsible for all the regular engineer work in his division such as charge of lights and engines, pumping plant, workshops, power stations or command telephone lines. But this work can only be done if there is a proper devolution of duties, both military and technical, to subalterns and subordinate staff.

In making up detachments, it is obviously best to allot men trained in coast defence work to divisions which include sea defences and lights, and to allot the works personal to divisions which include the land fronts of a fortress.

It is sometimes urged that the coast defence *personnel* are so fully employed in their special duties that they have no time to spend on works. This may be the case in some stations at home, but at all stations abroad the peace establishment is nearly the same as the war establishment, and it should be possible to employ a good number of men on works in the fortifications and barracks in the neighbourhood of their lights. In war time the numbers are sufficient to provide two reliefs, each relief being on duty for half the night. While night work involves a considerable strain when continued for some time, it does not preclude some work during the day, in fact such work gives useful occupation. I think therefore that the electric *personnel* can fairly be required to superintend all the special works, such as extra obstacles, preparation of parapets and similar services which have to be undertaken on the sea fronts of our fortresses in war time, and can also with civilian assistance carry out the minor maintenance of the forts and the buildings in or near the forts in which their lights are situated. They cannot however undertake the execution of works on land fronts at a distance from their lights.

A mistake is often made as regards the work of officers in electric light units in war. It is no part of the duties of such officers to themselves work directing handles, open or close switches or attend to telephones. Unless specially detailed in charge of a look-out post or acting as the senior R.E. officer of a fire command, the duties are those of a superintendent. They are responsible that their lights and everything connected with them are in thorough working order and that the arrangements for the supply of fuel and stores

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are complete, and also for the distribution to work, discipline and interior economy of the detachments under them. They should be present when lights are first started, and see that everyone is at their post and that all communications are in working order. If everything is correct it is then best to " leave well alone." The executive orders to the directors of moving lights are given by the officer or N.C.O. in charge of the look-out station, in the case of observation lights, and by the artillery officer in charge, in the case of fighting lights. Under this general procedure there should be no difficulty in electric light officers supervising works services in the neighbourhood of their lights.

Workshops.—The question of workshops deserves a short notice as it affects considerably the individual training and the peace and war distribution of the R.E.

Speaking strictly, a workshop is any building where stores and tools are brought together and manual work is done. Shops of this nature —which may be called hand workshops—are required by each group of workmen. Thus a small workshop is usually provided in each engine room for carrying out minor repairs and several groups of shops for carpenters, smiths and painters, etc., are required in any large division. Some of these may be supplied with one or more mechanical tools such as a power lathe, but it is generally more economical to arrange one set of shops in a central position fitted with machine tools, as this simplifies the provision of power, and the supervision of work. Such shops are called " central workshops."

At most coast fortresses the nucleus of such a shop already exists for the repair of electric light plant and electrical instruments. Some extension of this shop, such as the provision of a moulding plant and a heavy hammer, will make it an efficient central shop able to carry out any machinery repairs throughout the fortress. To this should be added a wood-working shop with sawyer's bench and machine tools, and the whole will then form a group of central shops.

In deciding what shops should be provided for the R.E. it is necessary to consider what other shops exist in charge of the Artillery, A.S.C. or A.O.C. It is desirable to avoid overlapping so as to ensure economical use of tools; on the other hand over-centralization involves loss of time and expense for transport of materials and articles to or from the central shops. Much of the work also is of a special nature. This applies to all the shops dealing with ordnance, and to such special work as the repair of barrack furniture or the wheelers' shop in fortresses which is concerned mainly with transport vehicles. Such special shops must of course be left in charge of their special corps.

The best general distribution of workshop duties is for the R.E. shops to be equipped to carry out all the heavier work of the fortress, such as castings, forgings, large repairs or renewals of machinery,

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leaving special work to be done by the corps concerned. The R.E. shops will also do all the work required in connection with engineer services and all repairs to electrical instruments.

The organization of the workshops should be on a military basis, the men of the R.E. employed in the shop forming a section or sections of a company and working under their own N.C.O.; but in addition there should be sufficient permanently employed civilians to ensure continuous work in the shops when the R.E. are withdrawn for training or military duties. All issues of tools should be treated as shop equipment, and issues should only be made to individuals from the shops. The practice of issuing tools direct from store to individual tradesmen is a fruitful source of loss, courts of enquiry and store troubles of all kinds.

In war time the R.E. shops will be very fully employed in preparing material for the fieldworks to be constructed on mobilization, such as shelters or obstacles. Most of the R.E. must, however, be withdrawn from the shops for work on lights or in the field. It is thus necessary to arrange to engage extra civilian labour on mobilization to ensure this work is not delayed. The electrical instrument repairing shop will be especially busy during war on account of the increased wear and tear on all the electrical plant. The staff of this shop cannot be reduced on mobilization and it is not easy to obtain qualified civilian labour.

O.C.E.L. and I.R.E.M.—A few words must be said for the position in our organization of the officers who are called "Officer in Charge Electric Lights and Telephones" or O.C.E.L. and the "Inspector of R.E. Machinery" or I.R.E.M. The latter is now purely an inspecting officer and has ordinarily no responsibility for the erection or working of machinery. His duties are to carry out certain tests of machinery on first erection and at periodical intervals, and to assist C.R.E. and D.O. with advice on machinery questions. He is assisted in carrying out his inspections by one or more mechanists. Except in some of the larger stations the duties of inspection do not take all his time, and the I.R.E.M. is then available to be employed as any other R.E. officer on duties such as charge of a division and in military duty with a company. The staff of the I.R.E.M. can also be employed in such duties as charge of a group of defence engines.

The O.C.E.L. combines the duties of an inspecting officer with that of an executive officer for certain electrical services. His inspection duties include the inspection of all defence lights and telephone services whether directly under him or under division officers. He is usually the commanding officer of the electric light company, in which case he is also responsible for the general distribution of men for light and telephone duties. His executive duties are mainly in connection with telephones as the administrative telephone service of a fortress cannot be subdivided and must be dealt with as a whole.

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It is advisable, however, that all telephone work involving alterations to buildings or fortifications should be done by division officers, and personally I think the best distribution of telephone duties is to make the D.O. responsible for all command lines in his area, leaving the administrative telephone system and main trunk lines under the O.C.E.L.

The O.C.E.L. used to be responsible for the stores for E.L. and telephone services, but since the formation of the central store system this responsibility devolves on the O.C. Stores. D.O.'s should correspond direct with O.C. Stores on all store questions, including stores required for electric lights and telephones on their charge.

In addition to his telephone work the O.C.E.L. may have direct charge of any movable or reserve lights. At a small station he may be a division officer.

Employment of Junior Officers.—Under the above system of organization it is contemplated that all officers below the rank of captain will be employed as assistants either to a D.O. or to the O.C.E.L. They should be given a definite charge such as the supervision of a portion of a division, or the execution of special services. Their work should be mainly executive as distinct from office work, but they must of course learn the office duties, and they will have opportunities of acting in charge of a division during the leave season.

Summary.—From the above it will be seen that the system of organization I recommend may be applied as follows :—

1. Work out the war distribution both as regards duties and numbers and allot officers, mechanists, foremen and other ranks according to the work to be done.

2. Subdivide the works services into a few large divisions following as closely as possible the war organization of the fortress.

3. Allot officers and men for special duties in the C.E. or C.R.E. Offices, under O.C.E.L., or in central workshops. Then allot the remainder to divisions following as closely as possible the probable distribution for war.

4. Arrange the interior economy of the company or companies, so that the officers and men allotted to a division form a distinct half-company, section or sub-section. Each divisional group will then constitute a local unit. It is not necessary that the sections shall be uniform in size or that each division shall have an equal number. A division with a small military section will make more use of civil labour and *vice versâ*.

Of course in applying the above rules, due account must be taken of local conditions. The organization recommended is not likely to be exactly applicable at any one fortress, but by establishing what may be an ideal organization we get an outline into which local conditions can be applied.

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TRAINING.

The training of the R.E. may be considered under the following heads, but it must not be supposed that the table is arranged in order of importance.

Engineer Training.—That is training special to R.E.

1. Technical training for electric light and telephone duties.
2. Training in " Works."
3. Training in " Fieldworks."

Military Training.—That is training which the R.E. share with other arms. *Engineer Training*, Sect. 15 (i.).

4. Drill and field training as an infantry company.
5. Musketry, visual training and ranging.
6. Signalling.
7. Engineer reconnaissance and map reading.

Standard to be Reached.—Before making some remarks on the details of the above, it is desirable to say a few words as to the standard required in any subject, as it is obvious that this standard cannot be the same for all arms or for all branches of a technical arm like the R.E. An example of this occurs in the *Musketry Regulations* where the training and classification of the R.E. and infantry is identical for the individual range practices up to 600 yards. But the training of the R.E. in the application of fire is limited to a small number of field practices all at comparatively short ranges.

In the same way, though engineer fortress companies are trained in drill and field training as an infantry company, it is not to be expected that they will reach the same standard. Indeed this is not necessary as an infantry company is being trained to take its place in a larger unit—the battalion—while an engineer fortress company will rarely fight even as a single unit, but more often as several separate sections or detachments. Similarly, I think it is unreasonable to expect from a company trained to coast defence duties, the same standard of efficiency in fieldworks and field duties as a works company.

When it is necessary to restrict a course or reduce the standard in any way, the safe rule is to make the reduction in the more difficult collective training. A man who has a thorough grounding in details can always be usefully employed but is of little use without that grounding.

General Arrangement of Training.—Training should be continuous throughout the whole twelve months of the year, but the actual dates for the different portions vary at stations abroad. The year is divided by regulation into two main portions for individual and collective training respectively—*Engineer Training*, Sect. 2 (i.), and

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the latter is divided into three portions—*Engineer Training*, Sect. 10 (i.), for (1) military training such as drill and musketry; (2) special technical instruction, such as fieldworks, or electric light running; (3) combined operations with other arms, and all these stages have to be considered for each of the seven subheads into which I have divided training above. It is, however, laid down in several places in regulations that there is no hard-and-fast line between the stages, and that individual training and the simple forms of collective training can be carried on throughout the year as may be convenient, in the intervals of other work. All forms of training must be practised by night as well as by day.

The number of subjects to be taught and this subdivision of the year may make the preparation of a programme seem a very complicated proceeding, but it must be remembered that in every system of education it is customary to include several subjects in any curriculum, to take several subjects in one day and to fix the time to be given to any subject by a detailed programme, or time table, prepared for some weeks in advance.

We may now consider the different forms of training in more detail.

Electric Light Duties.—The electric light training is divided into three portions, (1) an individual training spread over the whole year referred to in the footnote to Sect. 15, *Engineer Training;* (2) collective training at weekly practices; (3) combined training with other arms during an annual training of 12 days. The weekly running is largely used for night practice by the artillery, and their convenience must be considered in arranging dates. Some running is also required for practising the R.E., testing engines, etc., and on such occasions no attempt should be made to combine with other corps or instruction will suffer.

The annual 12 days running must be carried out when the full war manning is available, that is when any local forces are up for training, and must also if possible include the annual mobilization of the fortress. It is intended to act as a test of the efficiency of the machinery, and also accustom all ranks to the conditions which will prevail in war. All observing posts and artillery fighting posts should be manned during this training.

Some representation of fighting vessels is essential for a useful practice with electric lights, as the effect of the lighting cannot be properly observed by the illumination of the water only.

Telephone Duties.—Training in telephone duties is carried out by the necessary work in connection with the administrative telephone system. Command telephones are manned at the weekly practices and annual manning. It must be remembered that all men trained in coast defence duties should be practised both with lights and telephones. This can be arranged by an interchange of duties during

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the first part of the collective training. R.E. officers not trained for electrical duties should be given an opportunity of learning the general principles of working both lights and telephones.

Works.—The method of training in works is by employment on actual work in connection with forts, barracks, etc. This has been already dealt with at some length. The only training question to be kept in mind is that the junior officers should be given an opportunity of getting experience of all the different branches of work. This can be best effected by some rearrangement of duties annually, after the leave season.

Fieldworks.—It is laid down in *Engineer Training* that instruction in this subject shall be by an annual course lasting six weeks at which the whole unit should if possible be present. During this six weeks the whole of the *Manual of Military Engineering* has to be practised and at the end a special report has to be rendered to the War Office. I venture to think that this form of training is rather out of date and certainly not well adapted to the conditions of work of a fortress company.

In the first place, the concentration of any form of training into a continuous course is a departure from the principle, now adopted in all other subjects, of a progressive training commencing with the individual and culminating with combined practice with other arms. A "course" is apt to degenerate into a form of cramming, and the course once over the knowledge gained is quickly forgotten. In the second place, as I have shown above, the company in a fortress is rarely the fighting unit, and it is very inconvenient to stop all other work so that a whole company may go through the course simultaneously.

I suggest therefore that the training in this branch of work would benefit if it were spread over the year in the same way as drill is now taught. Instead of a cram, the practice of fieldworks would then become a habit just as drill is at present. There are many parts of the course of fieldworks, such as field geometry, knots, gabions and brushwood work, which are preliminary to combined work and can be taught to individuals or small squads in the neighbourhood of the barracks. Other portions as mining, hasty field defences, demolitions, railways or simple forms of work with spars, can also be practised by small parties, while the amount of special stores available in a fortress for bridging is insufficient to practise more than about 80 to 100 men at one time.

The usual difficulties urged against a distribution of this instruction over the year are the difficulty of getting tools and materials and of obtaining ground for practice. In most of our fortresses, however, there are old forts, whose ditches give excellent opportunities for practising bridging and whose glacis provide excellent digging ground for elementary instruction. As regards tools and materials,—under

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the system which has now been in force for some years, consumable stores including explosives are issued on an annual allowance which can be drawn at any time, and in any portions convenient for work; ordinary digging tools can be drawn at any time and in any quantity required; special tools such as saws can be drawn from the R.E. workshops, timber for bridging or fieldworks can be drawn from the special stock held in R.E. custody; in fact the only stores on which there is any restriction are cordage for bridging and the railway stores.

The arrangement I suggest for this training is to divide the course into three parts, (1) individual training carried out in one or two hours each week during the first part of the training year and in the intervals of other training—the exercises described in *Engineer Training*, Sect. 8 (3), can be combined with this training—(2) a course of about a fortnight devoted to bridging, partly over water and partly over land, carried out by half-companies or portions of a unit not exceeding 100 men at a time; (3) a fieldworks camp of two or three weeks during which actual work is performed as part of a tactical scheme; unless the digging ground is extensive it is not desirable to put more than about 100 men in one camp. Some transport for tools should be provided, and during this period subalterns can be sent out in charge of a section to carry out some scheme at a distance from headquarters.

The training should culminate in some form of combined manœuvres with other arms, in which actual work should be done by the R.E. in combination with infantry. Such schemes might deal with siege operations, or seizure and fortification of a position, or passing a force of all arms across a stream or arm of the harbour. Such schemes want considerable preparation in the collection of stores and hiring of ground and must of course be worked out with the General Staff of the fortress.

With the permission of the War Office we have actually tried a subdivision of the course at Malta for the last three years, and I am satisfied that better results were obtained than with the old system of a concentrated course.

There is one further point connected with this course which deserves comment and that is the combination of useful work with training. This means that certain works services in connection with the fortifications or the preparation of positions on the land fronts are set aside for execution during the annual course of fieldworks.

The advantages claimed for this are :—

1. Men take more interest in the execution of something of a useful nature and the time and labour required for demolition is saved.

2. More materials are available for actual work than can possibly be obtained for purely training purposes.

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3. There is an economy in utilizing the labour which is otherwise wasted during the training period.

On the other hand there are serious objections to attempting to combine training and practical work in this way, which in my opinion more than balance the advantages.

1. In order to assemble even a part of a company for training, arrangements have to be made to take men engaged in special employments, as clerks, draughtsmen, surveyors, photographers or trades special to electric light or telephone work. During their absence their special work remains in abeyance. It is desirable therefore not to extend the course unnecessarily.

2. A considerable number of different subjects have to be practised during the time allotted for training. Appendix I., *Engineer Training*, details 39 subheads of instruction which have to be disposed of in about six weeks of six working days a week. The time for each subject is thus short.

3. Any work of a practical nature usually includes the repetition many times over of the same operation, and also includes a good deal of purely fatigue labour for the handling of stores or large earth movements. It thus takes a considerable time to complete, and this time can seldom be spared during the period allotted for training without adversely affecting instruction on other subjects.

On the whole, I suggest as the result of experience that the time set apart for training is best expended in studying those parts of the *Manual of Military Engineering* which do *not* form part of the ordinary work of the Engineers in a fortress, and that actual work should only be done during training to a very limited extent. For instance, I have known a half-company giving up two out of the three weeks of the annual camp to the construction of a length of military road, to the exclusion of other branches of work, or spending a week or ten days in mixing and laying concrete for a gun position. Such work may quite properly be done by military labour but it could equally well be done during any other time of the year.

To illustrate my proposal I may take the case of a military road involving the selection of a track, two or three culverts over small water courses, some blasting, and the formation of the surface for (say) half a mile. The following might be done during the training,—the line of road could be laid out, a small portion including one culvert and a little blasting could be prepared up to formation level, and a part of this again completed with road material. This would be ample for instructional purposes. The road would then be completed after the training by any of the usual works methods. Or again a length of wire entanglement of 200 or 300 yards is required round the gorge of a fort, with holdfasts partly in rock. This is too big a job to be carried out as a whole, but a small portion may usefully be left for execution by parties under training.

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Drill and Field Training.—This is adequately carried out at present by allotting a certain amount of time each week throughout the year, and calls for no special comment.

Musketry, Visual Training and Ranging.—This is provided for in two ways, first by the allotment of certain days throughout the year for practice in judging distance and firing on the miniature and 30-yard ranges, and secondly by courses of firing on the full size ranges. The arrangement for these latter depend on the position of the ranges with reference to barracks, and the extent to which they are required for other corps. There is, however, no necessity to assemble a whole company for this training at one time, provided that all shoot at about the same time of the year, so as to equalize the conditions for the coveted marksmen's badges. A half-company is a convenient unit for this course. As ammunition is limited, musketry training should always be carried out very carefully and deliberately.

The habit of fire use and control can be acquired by always including some fire practice in every military exercise. Thus a route march becomes interesting if it has for its object the seizure and occupation of some defile or railway crossing, or parties at fieldworks can be attacked by a few men while at work, or a company drill on the barrack square can end by a manning of the boundary wall.

Signalling.—Engineer Reconnaissance and Map Reading.—These subjects though shown under collective training require mainly individual instruction and are best taught by weekly or monthly practices throughout the year.

As regards signalling I would express my regret that a knowledge of the Morse Alphabet should be entirely dropped. It has some advantages over semaphore as it can be used from a moving boat and under other circumstances where semaphore is unsuitable. It can also be used at night, with lamps, should telephone communication not be available, as for instance in directing mobile lights from a distance. Also simple telegraphic messages can be sent on a telephone by the Morse Alphabet when speaking is difficult. Both Morse and semaphore can be taught without flags or special appliances.

Arrangement of Training Programme.—The training year usually commences at the beginning of the leave or furlough season, which is fixed at the time of year least suitable for military work. Thus at home the training year begins on 1st November and ends on 31st October,—*Engineer Training*, Sects. 10 (1) and 8 (1)—the four winter months constituting the leave season for R.E. Abroad, the training year is fixed by the general officer commanding to suit local conditions, and in tropical and semi-tropical stations the leave season is in the summer or hottest time of the year. In arranging the training programme in such places climate must be considered, as this affects not only the time of year any particular training can be carried out but the amount of work which can be done in a day.

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At some stations a system prevails during the hot season of restricting parades and work to the early morning or late evening, but the standing order that Engineers should average eight hours' work a day throughout the year, usually requires longer working hours. My experience at three hot stations—Mauritius, Hong Kong, and Malta—has convinced me that the important factors for health are (1) adequate cover for the head and body when exposed to the sun ; (2) regular meals and sufficient time to eat them ; (3) sufficient time for ablutions, etc., especially on first rising ; (4) regular work or employment without overstrain. If these conditions are complied with, a good day's work can be done in the hottest weather. In fact, the early parades are rather harmful than otherwise, as they interfere with the breakfast meal. Whenever I have been able to apply my principle of a moderate working day, I have found the health report of the R.E. compared very favourably with that of the rest of the garrison.

In addition to climate there are other points to be considered. There are first of all the fixed dates of holidays and festivals, such as Xmas, Easter, King's Birthday and others. It is obviously undesirable for instance for Easter to come in the middle of the musketry course.

Next there is the trooping season with the arrival and departure of drafts. This always throws much extra work on the company staff for two or three weeks before the departure or after the arrival of a draft. At foreign stations where drafts are received at one or two fixed times of the year it is not desirable to put men through courses for the last few months of their tour, while newly arrived men should be instructed in local conditions as soon after arrival as possible.

The principal difficulties to be met are, however, those connected with the programme of works, which I have already referred to and which are due to the limitations of the financial year which runs from 1st April to 31st March at all stations. Under our system of financial control by Parliament the expenditure of each year is supposed to be complete in itself, so that in theory any " works " service should be begun and ended within the limits of one financial year.

Before work can be begun it is necessary to prepare detailed plans and to obtain the stores required, and at foreign stations many of such stores must be obtained from England. Plans and lists of stores can be prepared in anticipation in the previous financial year and the lists sent home, but the orders for the stores cannot be placed in England till funds are actually allotted at the beginning of a financial year, and the stores have then to be manufactured, inspected and shipped out to the station. The result of this is that most of the works services at foreign stations cannot be begun till about October or even later, so that during the last half of the year there

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is much greater demand for officers and men for works than in the first half. Further, the bills for work done are necessarily deferred till the end of the year, and this causes a very heavy strain on officers and office staff during the last few weeks, that is from the middle of February to the third week in March.

At home stations there is also this accumulation of work but not to the same extent. At home stations, the dates of the training and working year fit in very conveniently, as the period of greatest work falls in the leave season, which is also the trooping season. It is thus comparatively easy to assemble men for training during the summer months.

But abroad in the north hemisphere the leave season falls in the first part of the financial year, while the winter which is the best time for training, is also the busiest time for works and is the trooping season. It is advisable therefore in making out the works programme for the year, to arrange that work to be executed by R.E. labour should be begun early in the year. It is also desirable that the regular courses should be begun early and be carried out by half-companies or even smaller units so as to disturb the works organization as little as possible. I have already shown that such a subdivision of units for training purposes will give a better training than the system of collecting the whole of a company for a course, but it spreads the period of training over a larger part of the year.

The arrangement of the weekly drills and practices requires a little consideration. Some time every week should be devoted to steady parade drill, and this is usually given the first hour of one morning in the week. In addition we allotted the whole of Saturday up to 1 p.m. as the time for the weekly training. This time should be divided up in a regular time table prepared monthly by the company officers and so arranged as to include some of all the different subjects each month. If my suggestion to spread the field-work course over the year is adopted, it might be desirable to allot the first hour on another morning in the week to military subjects, such as knotting or signalling.

I may illustrate my proposals by an actual distribution of a training programme as it was carried out at Malta.

15th June to 15th October.—Individual Training.—Leave season for officers in two portions, furlough season for N.C.O. and men. Weekly drills and practices and electric light running. Detachments in camp for minor military works. The principal drafts from England usually arrive in September.

15th October to 15th December.—Bridging Courses.—A fortnight each carried out by one half-company at a time. Four courses in all, the coast defence company first.

15th November to 31st March.—Electric Light.—Practice in conjunction with artillery training, E.L. running on one or more nights

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each week, the annual 12 days manning taking place in February or March to coincide with the battle practice of the artillery. The local E.L. militia begin recruit training about 15th December and the whole corps come up for training from 15th February to 15th April.

During this period all R.E. officers can be trained in regimental exercises and schemes. The works company are also available for combined exercises and manœuvres with infantry on the land fronts.

1st to 30th April.—Musketry Courses.—By half-companies, one half of each company firing simultaneously. The Militia fire a course during the first fortnight.

1st May to 15th June.—Garrison Manning and Manœuvres and Fieldwork Camp.—The actual details depend on the command arrangements for manœuvres, which are again dependent on naval movements. During this period employment on works should be reduced to a minimum. Fieldwork camps can be formed by companies or half-companies as may be most convenient.

All the above dates are approximate, they vary a few days from year to year to suit the incidence of Easter and other holidays, and according to the days of the month on which Sunday falls. I do not suggest that the above is an ideal programme but it was at least a practicable one. But such a course of training is only possible if all ranks are sufficiently zealous to make full use of their opportunities. In conclusion I would add one word of warning which I have often given to individuals, both officers and N.C.O.'s, and that is "You cannot teach anything until you have first learnt it." All officers and N.C.O.'s should therefore carefully study their text books and regulations before trying to teach their juniors, and if necessary preliminary lectures should be arranged before the commencement of the practical work.

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THE RÔLE OF HEAVY ARTILLERY ON THE MODERN BATTLEFIELD.

A Lecture delivered at the School of Military Engineering by MAJOR R. O. MARTON, D.S.O., R.G.A.

I THINK that it would perhaps be well to commence the review of this subject with a consideration of what is meant exactly by heavy artillery. It may appear strange that such a consideration should be at all necessary, but even amongst artillery officers the term "heavy artillery" has been employed somewhat loosely to signify anything from a 4-in. gun to an 11-in. mortar, and thus frequently has caused a certain confusion of thought. I will ask you therefore to bear always in mind the official nomenclature as given in war establishments. Firstly, "A heavy battery and ammunition column" is an integral part of a division; it is armed with 60-pr. guns of 5-in. calibre, and is the only kind of "heavy artillery" which normally belongs to the field army. In addition to the normal establishment there are "units which may be required with, but do not normally form part of, the field army," and amongst these are given the establishments of

(2). A siege artillery brigade (medium).
(3). A siege artillery brigade (heavy).

When quoting from British official works, we must remember therefore that heavy artillery is confined to the 60-pr. batteries.

As the *rôle* that any weapon has to play in the field must necessarily depend on its capabilities, which in turn are designed to fulfil certain requirements, it cannot fail to be of interest to study the reasons which have influenced our choice of weapon or nature of weapon, and whether other nations have been influenced by the same reasons to a similar choice; or, if any divergence of opinion exists, the arguments in support of either side. The choice I have just mentioned refers of course to the necessity of coming to a decision as to what change or extension of artillery weapons should be made to keep level with the altered conditions of modern warfare. A variety of scientific and other causes have contributed to modify the tactics of arms other than artillery, and as artillery is the servant of the other arms, modification became necessary to keep an efficient artillery. Now power and mobility are both essential to an efficient artillery, but each is directly antagonistic to the other. One of the

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chief problems is to determine the proper mixture of power and mobility most suitable to the normal condition of warfare. It is obvious, and the point was brought home to us very earnestly in the South African War, that the greater the power the better, provided that a certain standard of mobility was maintained. So far there has been no divergence of opinion, and all civilized nations have added to their establishments weapons that are described as "heavy artillery," or weapons heavier than their field artillery which were weapons combining as great a power as was then imagined possible with the standard of mobility that was considered necessary for them.

With the choice of nature of weapon, however, the divergence of opinion commences, and, to put the matter briefly, we have decided on possessing a gun whereas all other countries have decided in favour of a howitzer. This divergence of opinion does not only exist between ourselves and other nations, but is to be found amongst ourselves without reference to other people, and has formed the theme of much discussion in the last few years. Three schools of thought may be said to exist viz. :—

Those who favour the gun.
Those who favour the howitzer.
Those who favour the possession of both.
(This latter to perhaps a minor degree).

The arguments in favour of each are many and strong, and I should not have the time to attempt to examine them all, or nearly all. Just to mention some of the main arguments may not be out of place, nor without interest in considering this subject. The chief argument in favour of the gun lies in its undoubted superiority as a shrapnel weapon as compared with a howitzer, and our existing 60-pr. can produce thoroughly effective fire of this nature up to 9,500 yards.

In this connection, however, it must be noted that the nations who have adopted the heavy howitzer in preference to the heavy gun, do not attempt to fire shrapnel from their howitzers, but only high explosive shell which they claim will destroy any nature of target. Against the introduction of a heavy howitzer it is also claimed that we already possess a howitzer, our present field howitzer, which will do all that is required from this nature of fire. It certainly is a powerful Q.F. howitzer firing shrapnel and H.E. shell of between 35 and 40 lbs. weight up to a range of over 7,000 yards. As regards weight of equipment and weight behind the team if horse transport is used, the gun is at a disadvantage compared with the howitzer. Comparing our 60-pr. gun with the German howitzer (5·9 in.) we have 108 cwt. as against their 59 cwt. behind the team of eight horses. Indeed the French claim that 11 cwt. per horse is the maximum weight that should be considered for continuous work on a campaign. This makes our 13½ cwt. per horse excessive, if judged by that standard.

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I have heard it stated, and it certainly is a very strong form of indirect argument, that one reason why we should include a heavy howitzer in our equipment, either in place of, or extra to, our present gun, is that we should then be armed in a similar manner to any possible foe we might be at war with. It does not follow that we should be at a disadvantage because we were differently armed, but judging by history it does frequently appear that one side will imagine itself to be at a disadvantage if the other side possesses some weapon of a different nature or strength. There is then a disposition on the part of the other to try and copy its opponent's weapon, which at the best results only in some sort of makeshift, and experience in its use has to be gained during the progress of the operations. As an instance of this, the South African War produced two examples. Firstly, we found our enemy in the possession of heavy guns to be used in the field, and we introduced our 5-in. gun on a very makeshift mounting to cope with them. The second example was the case of the 1-pr. Q.F. Maxim or pompom which we found being used against us. This was a weapon which I believe we had actually tried before the war and decided against its adoption into the Service. We considered, however, that we were at a disadvantage in not possessing it when our foe had it, and therefore introduced it during the war.

The first view was apparently the correct one, as our opinion of its value was so small that it has now been discarded again after letting our cavalry play with it for a time. As regards the introduction of a heavy howitzer in addition to our present heavy gun, there is doubtless much to be said against the further addition of complications to our equipment and ammunition columns and wheels accompanying a division unless some very well-defined object is going to be obtained by so doing. In some quarters it is maintained, however, that there is a *rôle* for both the heavy gun and heavy howitzer in addition to the field gun and field howitzer. It certainly is very possible to imagine the great effect that might be produced by heavy howitzer H.E. shell on strong field fortifications such as may well be found on modern battlefields; on defended villages such as were the case at the Battle of Mukden and which withstood the Japanese bombardments and assaults for four days successfully; on shielded batteries whose *personnel* might well be destroyed by the all-round devastating effect of the splinters of large H.E. shell detonating in a complete manner. I say that it is not only very possible to imagine these results being produced by the heavy howitzer firing H.E. shell, but also very possible to imagine that these results could not be produced as quickly or as satisfactorily, if at all, by any other form of heavy field artillery of our present equipment.

It is impossible to leave this question of gun *versus* howitzer or

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both without referring to a form of heavy artillery which I mentioned at the beginning of these remarks as having a status in war establishments, but not recognized as normally forming part of the field army although it may be required to act with it. I refer to the mobile siege artillery brigade of medium howitzers. On mobilization this brigade would consist of four batteries of 6-in. B.L. howitzers with an ammunition column to each two batteries. These howitzers fire a 100-lb. H.E. shell of great power and shrapnel as well, but their maximum range is a short one.

Also, it is probably recognized universally that our 6-in. howitzer, whatever may or may not be its merits as a siege howitzer, is not the most suitable weapon to take into the modern battlefield. Its range is short, and its mounting deficient of several elements which are now regarded as essential for service in the field. In regard to this discussion on the best nature of heavy artillery for us to possess, I hope that I have put the *pros* and *cons* of the question so impartially that I have left you in complete ignorance as to what are my own personal and unimportant views on this question.

I think it will be convenient at this period to refer to what is given in our official text book (*F.A. Training*, Sec. 144) on the characteristics of "heavy artillery," which is as follows :—

"The special characteristics of heavy artillery are accurate long-range fire and great shell power, but these advantages are to a certain extent discounted by a limited mobility. The long-range fire of guns of this nature should be utilized to bring enfilade and cross fire to bear on the enemy's positions. The sites chosen for them should be such as to facilitate fire being brought to bear on as much of the ground occupied by the enemy as possible. In normal circumstances these conditions are most likely to be obtained by dispersion.

The fire of guns of this nature is of special value against shielded guns, fortified localities and buildings.

Owing to the limited mobility of these guns and the fact that they are unprovided with shields, considerable risk may be incurred without adequate compensation, if they are placed too far forward or exposed to a flank. Occasions may however occur, when to gain decisive results it will be necessary to use them in line with those of lighter calibre.

If well protected and placed on the flanks of a defensive position in an open country, their long-range fire may compel a turning movement to be made on so wide an arc, that time, valuable to the defenders, may be gained."

Thus laid down we have the principles to guide us as to the *rôle* the heavy artilleries will have to assume on the modern battlefield, and we may now proceed to examine them in detail, and, where profitable, to compare them with those of our neighbours.

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(May I again just remind you that we are dealing only with the official 60-pr. batteries).

Accurate Long-Range Fire and Great Shell Power.—The 60-pr. is an extremely good shooting gun and its long range and shell power as compared with the field gun scarcely require comment, covering as it does with effective shrapnel fire with deep zones all ranges up to 9,500 yards and common H.E. shell up to 10,000 yards. A great asset to a good long-range gun which must not be overlooked, is the great accuracy and the tremendous power at the shorter ranges such as we might well be limited to in many European countries.

The loss of mobility referred to as a disadvantage to be set off against this increase of range and power is not, except for tactical reasons, as acute as might at first be imagined. Under modern conditions with the more prolonged battles, the longer intervals between them, the improved means of communications in most theatres of war, the presence of heavy artillery at the right time and place is facilitated and its comparative lack of mobility can then be eased by its tactical employment.

The long-range fire is expected to enable an enfilade or cross-fire to be brought to bear on the enemy's positions, and we see it laid down that, from any site chosen, as much as possible of the enemy's ground should be capable of being brought under fire. Dispersion of guns is suggested under normal conditions. Furthermore *Combined Training* in assigning the *rôle* to heavy artillery of supporting the firing line in the final stage of the attack, explains that the fact of "its great shell power and long range, enabling it to bring a concentrated fire on all points selected for assault" makes this *rôle* peculiarly applicable. Now the enormous advantages of enfilade fire or even oblique fire are self-evident, but it is very open to question whether the attainment of this much-desired end will be so easy in the large majority of instances. Undoubtedly the long range does facilitate this aim, but there is a danger in too much stress being laid on this point. As General May once said in a discussion on this subject "it might result in zealous officers wasting a great deal of time in looking for positions whence they could obtain enfilade fire, when very possibly such an ideal position is not discoverable owing to lack of existence." Enfilade fire means fire from a point on, or close to, the prolongation of the enemy's line. Unless it be parallel to the enemy's line, it will not be true enfilade fire. It may be oblique fire, but it is not always easy to get even oblique fire. You no doubt can obtain enfilade fire against certain portions of the enemy's position where his line is indented or turned back, but except from a flank you cannot enfilade his position as a whole.

Now there are certain objections to placing guns of this nature too far on the flanks, at any rate in offensive operations. There is the sound principle of covering as much of the enemy's ground as possible

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from the site chosen, remembering that the movement of guns once committed will not always be an easy operation, and also the limited mobility of these particular ones. Concurrence with this principle involves a much more central position and a very carefully chosen one too. In discussions on this subject, there has been disclosed a reluctance to consider the employment of such guns on the flanks where counter attacks by a vigorous enemy may be expected and where guns of greater mobility are therefore desirable. Also, for the protection of guns so placed, your line may have to be extended beyond them to such an extent as to materially upset your calculations.

So practically it boils itself down to the conclusion that for good working principles an officer seeking for a position for heavy artillery should choose one in a more or less central and well-protected position, as near in as he can get with safety, and then let him get as much enfilade, oblique or cross fire out of it afterwards as he can.

I think dispersion of guns is a natural corollary to the large extent of modern battlefields and also to the fact that we only possess one heavy battery to a division. From the conclusions arrived at as regards the position of our heavy artillery, we shall see that no special line can be taken in its *rôle* of "supporting the firing line in the final phase of the attack." The cross fire advocated in *F.A. Training*, and the enfilade fire so admirable in theory for rendering such support, will have to depend on circumstances, and perhaps as often as not this support will have to be rendered with frontal fire over the heads of our own troops. This operation which has naturally been frequently termed the most delicate one that artillery of any nature can be called upon to perform, may very often be one of peculiar difficulty for heavy artillery. It may have to be attempted at long ranges when the difficulty of keeping touch with the attacking infantry becomes greater than ever. The communication and co-operation between the infantry and artillery under such circumstances is a gigantic question. For effective observation of fire and also to watch the situation or keep in touch with the director of the operation when firing at long ranges, a battery commander or his observation officer will generally be at some considerable distance from his guns with which he will be in telephonic communication. It is open to question whether such communication, however admirably carried out, will be quick enough, and whether it would not be better for heavy artillery at this stage to cover the advance of other artillery moving up to the close support of the attack.

As an instance of the infantry point of view on this matter, a criticism made at a powwow at one of the tactical days of practice with live shell which now forms part of the training of field artillery, was rather interesting. The battery on this occasion was supporting an attack on a certain position, and to represent the final phase a row

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of dummy targets was suddenly raised to show our infantry making the final assault. The battery was at some distance from the position where both the infantry and artillery officers were stationed and communication to the battery was by telephone. The battery was to be ordered to cease fire, and certainly the order to that effect was not passed as quickly as perhaps it might have been, but one could not say that there was any undue delay. The point in the criticism was that even the telephone was too slow and that instant verbal orders to stop firing would be preferable. I would mention that this was a howitzer battery firing from a covered position, and that the battery commander was necessarily therefore prevented from both observing the progress of the attack and commanding his battery by voice. To conform to the wishes of the infantry as expressed on that occasion it would have been necessary for the battery or batteries supporting the attack to have been pushed forward to very much closer ranges, or even to close behind the firing line in which task they could be covered by the fire of other batteries. Whether they could get there, or whether the 18-pr. batteries with their flat trajectories would be much use if they got there would depend upon the circumstances of the particular case. In furtherance of this idea and to meet both these difficulties, light pack howitzers have been suggested as standing both a better chance of getting forward and being of use when they get there. In fact in *F.S. Regulations* such a course is laid down to be acted upon by mountain artillery. From the nature of our heavy artillery weapon it is essentially one that will produce greater effects against *personnel* than against material targets. In this respect there is perhaps a fundamental difference between our heavy and the corresponding artillery of the German and French Armies. Their primary *rôle* may be said to be the attack of material such as permanent or semi-permanent fortifications, and the attack of *personnel* a secondary *rôle* though they claim equal success in regard to the latter. No doubt a reason for their choice of the howitzer, and the organization of their howitzer battalions, lies in the fact that they expect them to be used early against the strong places and barrier forts to be found on their land frontiers, on the speedy overcoming of which much of the freedom of movement for their field armies may depend.

To refer again to *F.S. Regulations* we find it laid down that the principal duty of our heavy artillery is (1) to silence at distant ranges (over 6,000 yards) hostile guns that may command lines of advance. A good example of this is given in the attack by General Buller on Allemans Nek in S. Africa, where the Boers reserved the fire of their artillery which commanded the line of advance of our infantry, until the latter were well committed. Our 5-in. guns both silenced the enemy's gun and covered a change of position of two field batteries who then enfiladed the Boer position on the S.E. of the Nek and this proved the turning point of the action. Numerous

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instances also occurred where the Japanese, without heavy artillery, were unable to silence Russian batteries which swept important lines of advance, and prolonged combats and great sacrifices were the result of this deficiency.

(2). To search and enfilade points which the lighter guns can only reach with frontal fire. We have referred before to the difficulty of attaining this admirable end. Again it is easy to point to many cases where the Japanese would have saved much time and great losses if possessed of a heavy artillery to perform the above duty. It must of course be remembered that the Russians in selecting their positions knew that their foe was deficient of this arm.

(3). Destroy villages and houses. This involves the use of H.E. shell. Villages may be occupied as temporary shelters to collect in prior to a further advance, or occupied as tactical points when probably powerful earthworks may have been constructed. The reduction of the latter case is a much more suitable task for heavy howitzers.

(4). Again refers to support of final attack which we have discussed.

(5). Refers to long range fire between 6,000 to 4,000 yards and gives as its chief object during the general action "to sweep as large an area as possible within the enemy's position." A good example of this is found in the forcing of Botha's Pass by General Buller. Two 5-in. guns were man-handled into a very carefully reconnoitred and prepared position whence they were able to sweep the Boer position from end to end, and the latter never manned their trenches properly in consequence.

This result cannot be effected if the guns are placed too far from the front of the position to be attacked, and 4,000 yards is given as a distance nearer than which heavy artillery with its lack of mobility should rarely approach. It must be remembered that these guns are not provided with shields. At one time it was recommended that they should be but it was never carried out, owing I presume to the fear of still further increasing the weight of the equipment. For this reason, amongst others, such guns would generally be placed in concealed positions and entrenched. We saw it laid down that to gain decisive results, occasions may occur when it is necessary to bring heavy guns forward into line with those of lighter calibre. This can only be looked upon as an exceptional use of heavy artillery. Such action was not unknown in S. Africa, but only when there was no effective artillery opposition on the part of the Boers. No doubt it would only be wise or possible under this condition.

In the defence, it is suggested that heavy artillery be placed on the flanks to fulfil certain objects. The conditions in the defence are simpler than in the attack and do not make the same demands on mobility or on a high degree of field training with other arms. Such positions may compel any turning movements to be executed

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on a wide arc and so gain valuable time for the defence ; will support counter-attacks made from either flank and tend to prevent the attacking artillery from taking up positions from whence it might obtain enfilade fire—will enable cross fire to be brought to bear on the front of the position, thus compelling early deployment of the attacker's infantry and preventing his batteries from coming into action at short ranges. Given first-rate conditions fulfilling these points, a large amount of the defender's artillery would be left free to deal with the attacking infantry, to the great advantage of the defence.

Both in the attack and the defence it can be said with a great deal of truth that the success of the operations of any one day will largely depend on the initial distribution of the batteries with respect to the tasks allotted to them, and it is a platitude perhaps to refer to the careful and thorough reconnaissance which should be a prelude to the selection and taking up of positions. In the absence of knowledge on essential points or until the situation had cleared up, the divisional commander would generally retain his heavy artillery under his own hand, ready to throw it in when and where required. It might be ordered into a "position of observation" ready to cover the advance of other batteries, and this covering power is a very valuable asset in heavy artillery.

There are certain *rôles* that one can imagine being assumed by heavy artillery that are not mentioned in our training manuals, viz. in pursuit and acting on rear guards.

It may seem a strange idea suggesting the least mobile form of artillery taking part in a pursuit. Certainly a great deal would depend on the nature of the country being traversed, and its communications and the strength and *morale* of the opposing forces. But such a long range gun in pursuit might oblige a rear guard to maintain itself at least 5 miles from the tail of the main body it is protecting. Such a distance would increase the already difficult task of a rear guard in avoiding being cut off from its main body. In open country long range guns pushed to the front for this purpose should ignore the rear guard and make the hostile main body their objective. Similarly in open country or a country suitable for the employment of heavy artillery great value may be obtained by placing such guns with the rear guard thus causing the pursuers to deploy at considerable distances and retarding them.

These considerations rather lead us to examine the best position for such guns on the line of march. Naturally, depending upon the nature of the country and the situation, the position may be anywhere from one end of the column to the other.

However, some might well be placed at the head of the main body, or even with the advanced guard if no stubborn resistance was likely to be met with, and if it was important that the march

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should not be delayed by small bodies of troops in advantageous positions.

We have just mentioned the value such guns might have acting with the rear guard, but if roads were bad it might be unwise to risk them in such a position. Again in close country, wooded or flat or against an enemy well provided with mounted troops, a position somewhere near the centre of the column would be advisable.

I think that very little use could have been made of any form of heavy artillery, for instance, in most of the country in Norfolk and Cambridgeshire where this year's manœuvres were held.

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CONSTRUCTION OF A REINFORCED CONCRETE FLOOR, DALHOUSIE BAKERY.

By COLONEL H. C. NANTON, R.E., AND LIEUT. H. S. TREVOR, R.E.

IN a Bakery being constructed at Dalhousie, baking and storing will be done on the ground floor, for which a room of 66½ ft. by 40½ ft. is required. This will be subdivided by railings to provide spaces for an entrance vestibule, office, bread store, issue vestibule, etc.

Above it the first floor is constructed to carry a load of 400 lbs. per square foot, on which will be placed the main and expense flour stores, as well as the heavy kneading machine and oil engine to work it. In the main flour store one year's supply for the whole garrison of Dalhousie will be collected.

The first floor consists of a 10-in. reinforced concrete slab 66½ ft. by 40½ ft. resting on the side and end walls of the building, and supported down its centre by three reinforced concrete pillars 14 ft. high and 2 ft. in diameter. The slab is quite smooth and level top and bottom; it is complete in itself without either beams or rafters, except where large openings for stairs or lifts are required. In this case one reinforced beam from a pillar to a side wall is given on account of a stair opening. The pillars and floor slab were cast *en bloc*, and the edges of the slab extend well into the side and end walls on which they rest.

The temporary work required for construction was simple, and consisted of a plain false floor of two layers of ¾-in. sawn planking upon which the concrete slab was cast. The uprights which supported the false floor will ultimately be roof rafters and the planking roof covering under galvanized iron sheeting. The false floor was brought to an accurate level by reverse wedges placed below the feet of the uprights, and the joints between the planks were either covered by oiled paper, or pointed with mortar or mud to prevent the matrix passing through.

On the false floor, boxes were set up, so that, when the floor slab was cast, the openings for the ventilator, dough shoot, and stairs, were formed. Up the centre line of the false floor three holes, 4 ft. in diameter (the dimensions of the fluted pillar heads) were cut, and the upright rods of the pillars passed through them. After the pillar uprights and spirals were placed, the pillars and caps were enclosed by light sheet iron casings.

The reinforcing rods of the floor slab were then laid, and a wet

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mix of Portland cement concrete was poured in, firstly, filling the pillars, and then extending 10 in. thick across the whole floor. This operation was done as quickly as possible.

One month after pouring the concrete, the pillar casings were removed and the false floor struck by knocking away the reverse wedges under the uprights. The false floor and uprights then became available for constructing a second reinforced concrete floor to carry assorted S. & T. Stores.

The reinforcing used was the " mushroom system " of reinforced concrete, in which the vertical rods of the pillars are bent outwards to form a mushroom head rising towards the top of the floor slab. A mesh of rods reinforcing the slab is thus raised to the top of it where it passes over the mushroom, so placing the steel suitably to take the *shearing* strains.

The pillars are designed to carry a working load of 250 tons each in case a second floor is constructed, and are 14 ft. high and 2 ft. in diameter over all. To distribute this pressure, the foundations consist of two footings of Portland cement concrete reinforced at their bottom faces by a four-way grill of round steel rods. The foundations pressure is thus reduced to about $3\frac{1}{2}$ tons per square foot.

The pillar footings were formed by rough wooden boxes open top and bottom. In these boxes the reinforcing grills were placed and a wet mix of concrete poured. After a few inches of concrete were placed, the grills were lifted to admit of the mix flowing under to a depth of about 1 in. below the bottom bars. The remainder of the mix was then poured and pushed into place by foot.

The reinforcement of each pillar consisted of eight upright $1\frac{1}{8}$-in. diameter rods on the circumference of a 21-in. circle, surrounded by a $\frac{7}{16}$-in. spiral opened to a pitch of $2\frac{1}{4}$ in. The uprights were spliced to vertical stub rods cast in the upper footing of the pillar. At the top, centre, and bottom of each pillar, punched bar hoops surrounded the uprights. The punched projection of these hoops formed distance pieces to hold the temporary sheet-iron casings in position. When casting the pillars a skin was thus formed outside the spiral. The cores were clear and there was nothing to retard the flow of the concrete or to cause voids in the cores.

The eight steel uprights of the pillars were brought well towards the top of the floor slab, and then were bent backwards and outwards until their ends came within $\frac{1}{2}$ in. of the bottom of the slab. Overlying these were placed two $\frac{7}{8}$th diameter rings, the outer being 8 ft. 9 in. in diameter, and the inner 5 ft. in diameter. The mushroom heads of the pillars thus formed had the appearance of dished cart wheels.

The floor slab reinforcement consisted of a four-way mesh of $\frac{7}{16}$-in. diameter rods arranged in bands, lengthways, cross-ways, and

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diagonally in each direction. With the exception of the side and end bands, they all cross the mushroom heads of the pillars. The mesh is thus densest where it passed over the mushroom heads, and where it rests on the walls, *i.e.*, at the places where the slab is subjected to shearing strains. Where the mesh falls to the centre of the slab panels its density is less, as here so much steel is not required.

When the reinforcing rods of the pillars and the floor slab were laid, the sheet-iron casings of the pillars-caps and pillars were well greased and placed in position, the former being joined up to the false floor as neatly as possible with small sheets of tin tacked to the floor. The false floor joints were closed roughly by tacking oiled paper along the most open seams and by pointing others.

A wet mix of 1—2—4 P.C. concrete was then brought by wheelbarrows on to the false floor; the pillars were first poured full and afterwards the 10-in. floor slab was cast. The mix was sufficiently liquid to flow readily, yet not so thin as to allow the matrix to part from the aggregate. No ramming was done, and all that was necessary was to lift the reinforcing mesh slightly at the centres of the panels to allow about $\frac{3}{4}$ in. of concrete to flow under it.

In practice it was found impossible to cast the whole slab and the pillars in one operation, and the work was extended over three days. The slab was divided into three sections by boards on edge across the building, a pillar being under the centre of each section. Each section was completed to its full thickness and the joint for the next day's work was across the centre of the panels.

Note on the "Mushroom" System of Ferro-Concrete.—The system of ferro-concrete construction used in the Dalhousie Bakery is known as the "Mushroom" System of Ferro-Concrete Construction, is the invention of Mr. C. A. P. Turner, of Minneapolis, U.S.A., and is a patent. The name used for the system is derived from the shape of the reinforcement over the heads of the columns, and also from the rapidity with which buildings can be constructed. As the system is a patent, and the formulæ used for calculation dependent upon practical experiments, supported by the very large experience of the inventor in ferro-concrete construction on a large scale, floors should not be designed and put up on this system without reference to him.

The system consists of continuous flat slab floors, of uniform thickness throughout, supported by columns or construction walls, as required. The floor slab is divided for purposes of calculation into panels, with a column at each corner, or with walls on two sides according to circumstances. The formula used for computing does not consider the slab as "continuous," and so will serve for any panel of the floor, whether supported on walls or columns. The arrangement of the reinforcement in the floor slab is such that loads placed anywhere on it are transferred *direct* to the supporting

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columns or walls, instead of through a system of beams at right angles. The steel is arranged in a network of rods of uniform size, so that the floor is most strongly reinforced where the stress is greatest, while the crossing of the rods serves to distribute concentrated loads over as large an area as possible. The whole floor slab, and also the supports, are thus tied together into one monolithic mass.

The strength developed by any panel of the floor under test loads is very great, and as the result of a number of experiments under varying conditions, the inventor has adopted the value $\frac{WL}{50}$ for the maximum bending moment in a uniformly loaded slab, W being the total load in 1,000-lb. units, and L the span in feet. This value allows a factor of safety of 4 (reckoned against the ultimate strength of the slab). The working stress of the steel is about 13,000 lbs. per sq. inch.

The reason for the low co-efficient of bending moment occurring in the loaded slab is probably due to the " flat plate " action of the portion of the slab enclosed within the lines of maximum stress. This line, shown dotted in *Fig.* 1, can readily be determined by

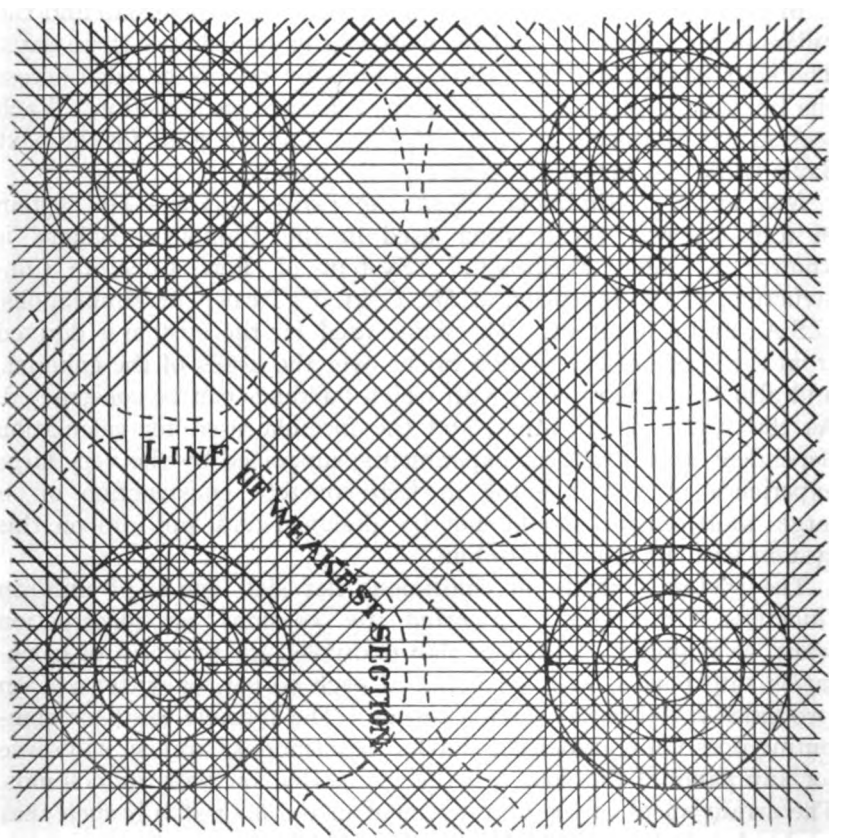

FIG. 1.

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loading a panel until it fails, when the lines of rupture are found to run approximately as shown. It will be seen that the central portion of the space enclosed by these lines of maximum stress is roughly circular in shape, and is in the middle of the panel. It has been proved mathematically (by Professor Orashoff and others) that the bending moment at the centre of a circular flat plate of homogeneous material and uniform thickness, uniformly loaded and supported at its outer edge, is *zero*. It therefore appears reasonable to suppose that a similar state of affairs exists in the central portion of the Turner panel when uniformly loaded, and that the two-way reinforcement in this region serves mainly to distribute the tensile stresses occurring along the lines of maximum stress to other portions of the panel. The compressive bending stresses in a panel supported on all sides are as shown in *Fig.* 2, *i.e.*, in two directions at right angles. These stresses can be held in equilibrium diagonally as shown in *Fig.* 3, thus relieving the portion enclosed in these diagonals of the stress. Since the reinforcement in the centre

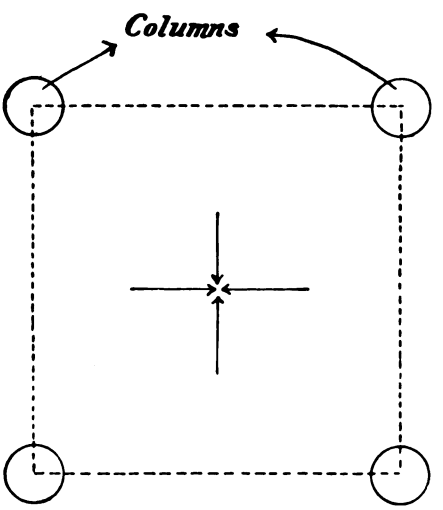

FIG. 2.

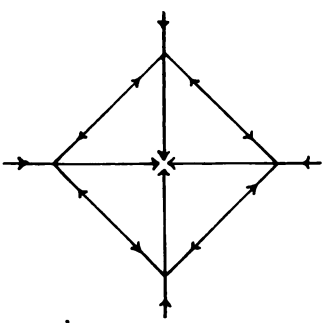

FIG. 3.

of the Turner panel is diagonal, it is probable that the compressive stresses are forced to act diagonally, opposing the tension in the steel, and thus relieving the centre of the panel of the major portion of the stress, which would otherwise accumulate there. Thus the " flat plate " action of the slab, and the effect of the diagonal reinforcement distributing the stresses laterally, both tend to strengthen and stiffen the panel and probably account for the low co-efficient of bending found by practical experiment. The theoretical investigation of the stresses in the panel is too complex to be of value, when the safe loads can be determined far more accurately and reliably

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by testing actual panels. The great success of the system in America conclusively proves that the formula evolved by Mr. Turner from actual experience is thoroughly reliable when the work is properly done.

Though the reinforcing network is carried up to the top of the slab over the mushroom heads of the columns, the slab is not regarded as "fixed." The raising of the network brings the steel well into the concrete round the pillar, and also places it nearly at right angles to the planes of shear, which are not quite vertical. The network runs in four directions, over the mushroom heads, so as to provide the greatest amount of reinforcement where the shearing stress is greatest. The mushroom head of the column serves to prevent the tendency of the latter to punch through the floor slab.

The columns are of the Considere type, but the vertical reinforcing rods are bent out at the top to form the mushroom head, like the frame of a flat umbrella, and the network rests on this. The bent ends are held in place by two ring rods (*Fig.* 4). Detail of the

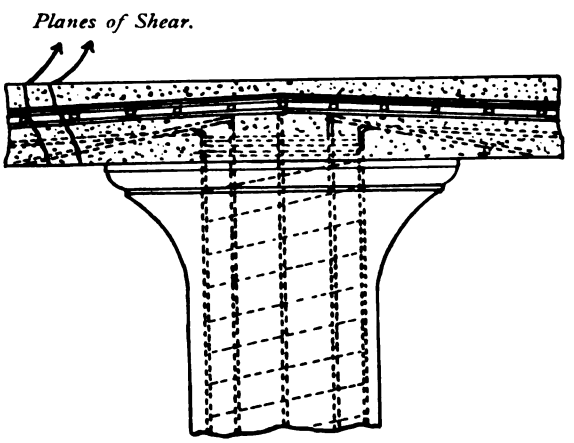

FIG. 4.

columns are given in the *Plate*. When the column rests on the ground, the footing is of slabs, reinforced at the bottom face in four directions, and the vertical rods of the column are splayed out over the network in the footing slab. When there are several floors in a building, the vertical rods of the lower pillars are not carried up into the pillars above, nor those of the upper pillars into those below, but the upper column rods merely rest on the top of the mushroom head below. The reason for this is that the tendency for the pillars to punch through the floor appears to be increased by making the vertical reinforcement continuous up the columns from top to bottom of the building.

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Among the advantages claimed by the inventor for this system over other forms of ferro-concrete construction are :—

(i.). Great strength and reliability owing to monolithic construction and consequent resistance against fire, and disintegration by earthquake, or vibration from machinery.

(ii.). Low cost and simplicity of construction, as compared with other systems requiring complicated joinery in the false work.

(iii.). Rapidity of erection. Large buildings have been erected at the rate of one floor per fortnight, in America.

(iv.). Economy in height, owing to absence of deep beams: better appearance and lighting.

(v.). Elimination of dust, owing to absence of corners and angles.

(vi.). Ease in alteration of the internal partition walls, if required, without interfering with the floors.

(vii.). No skilled men required, and dangers from slipshod work largely eliminated.

The joint was freely grouted with neat cement and was carefully kept vertical, for on this line the effective compressive strength of the concrete comes into play.

The concrete mixers (twelve in number) consisted of semi-circular sheet-iron troughs held in trunnioned wooden cradles, one-third of the cradle projecting over a dwarf wall at the foot of which wheelbarrows passed. As each mix was ready the end of the cradle was lifted, and the liquid mass poured into the barrows. Each mixer took 2 c. ft. of aggregate, 1 c. ft. of sand and ½ c. ft. of cement. Two men per mixer turned over the ingredients and the fluidity was carefully maintained by measured water added to each mix. The complete floor slab and pillars were cast in three days, about 1,000 c. ft. of concrete being mixed and poured per day of six hours.

The mushroom system for reinforced concrete floors is much in vogue in Canada and the United States, and it results in a continuous smooth floor slab of equal thickness throughout, without projections or beams of any kind, except about large openings for stairs or lifts.

Floor slabs of any area can be constructed and it is found that the rows of pillars supporting them should not as a rule be more than 25 ft. apart where very heavy weights are to be carried.

The outer edge of the slab may rest on construction walls or be supported by pillars spanned by reinforced beams and the fronts of the buildings can be of any style designed by the architect.

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Owing to the fact that the strength of the slab is evenly distributed, and that internal walls form no essential part of the construction, such walls may be light and may be placed where desired without reference to those on the floors above or below.

The ease with which internal alterations can be made is a great advantage and renders this construction ideal for barracks, hospitals and public offices.

REPORT ON LOADING TEST CARRIED OUT ON 9TH AND 10TH MARCH, 1913, ON THE REINFORCED CONCRETE FLOOR OF DALHOUSIE BAKERY.

(1). *Portion Tested.*—It was possible to subject only one panel of the floor to a test load, and the largest panel, measuring 20¼ ft. × 16⅝ ft. = 341 square feet, was accordingly selected. It is supported along one of its long sides by the bakery wall and at each corner of the opposite side by a pillar.

(2). *Load.*—The load consisted of full grain bags weighing 81 lbs. each and full flour bags of 84 lbs. each. These were laid flat in layers covering the whole panel. Each of the first 15 layers contained 99 bags = 1,485 bags, and a further 183 bags were heaped on top, making a total weight of 136,410 lbs. After adding the weight of tarpaulins and stones for holding them down, the total test load amounted to 138,500 lbs. = 61·8 tons, or 406·4 lbs. per square foot. The average height of the load was 11½ ft. or 1½ above the eventual height of the room.

No count was taken of the additional weight of men.

(3). *Results of Test.*—A levelling staff was suspended from the centre point of the panel and frequent observations were taken with a level.

Twenty-four hours after loading began, the deflection observed was ·48 of an inch and appeared to have reached its limit. Twenty-four hours after unloading began, the recovery observed was ·264 of an inch. It is not known whether any further recovery took place, but a discrepancy between deflection and recovery is in accordance with tests carried out in America.

(4). *General Remarks.*—Ever since construction, in October, 1912, the floor has been exposed to rain and snow, and has never had a chance of properly drying out. Moreover its finishing coats of cement grout and plaster have not been applied. This process, according to American experience, very considerably strengthens the floor and future tests will be carried out after completing it.

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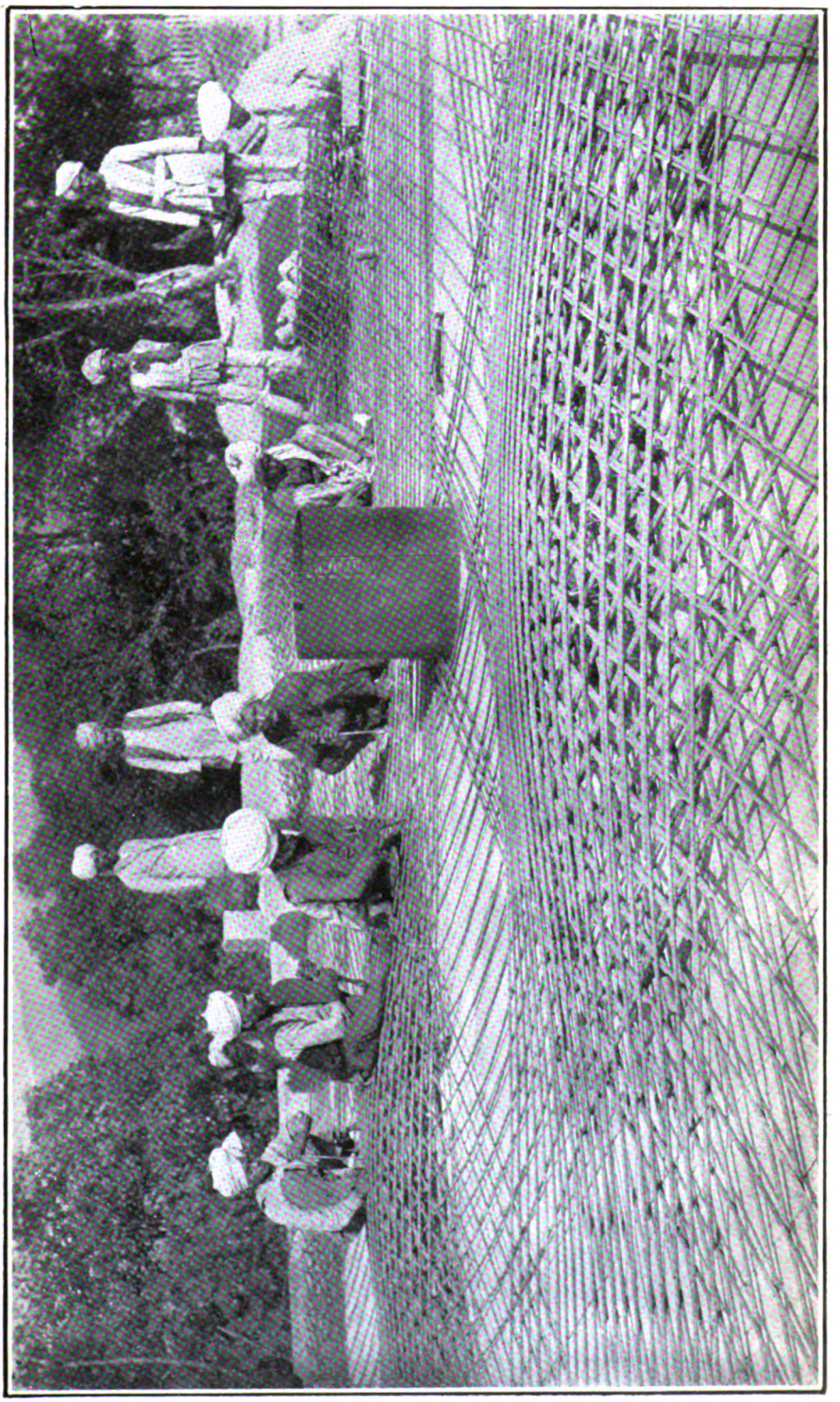
CONSTRUCTION OF A REINFORCED CONCRETE FLOOR, DALHOUSIE BAKERY.



Fourway Mesh reinforcing the Floor Slab, showing the Rise over the Mushroom.

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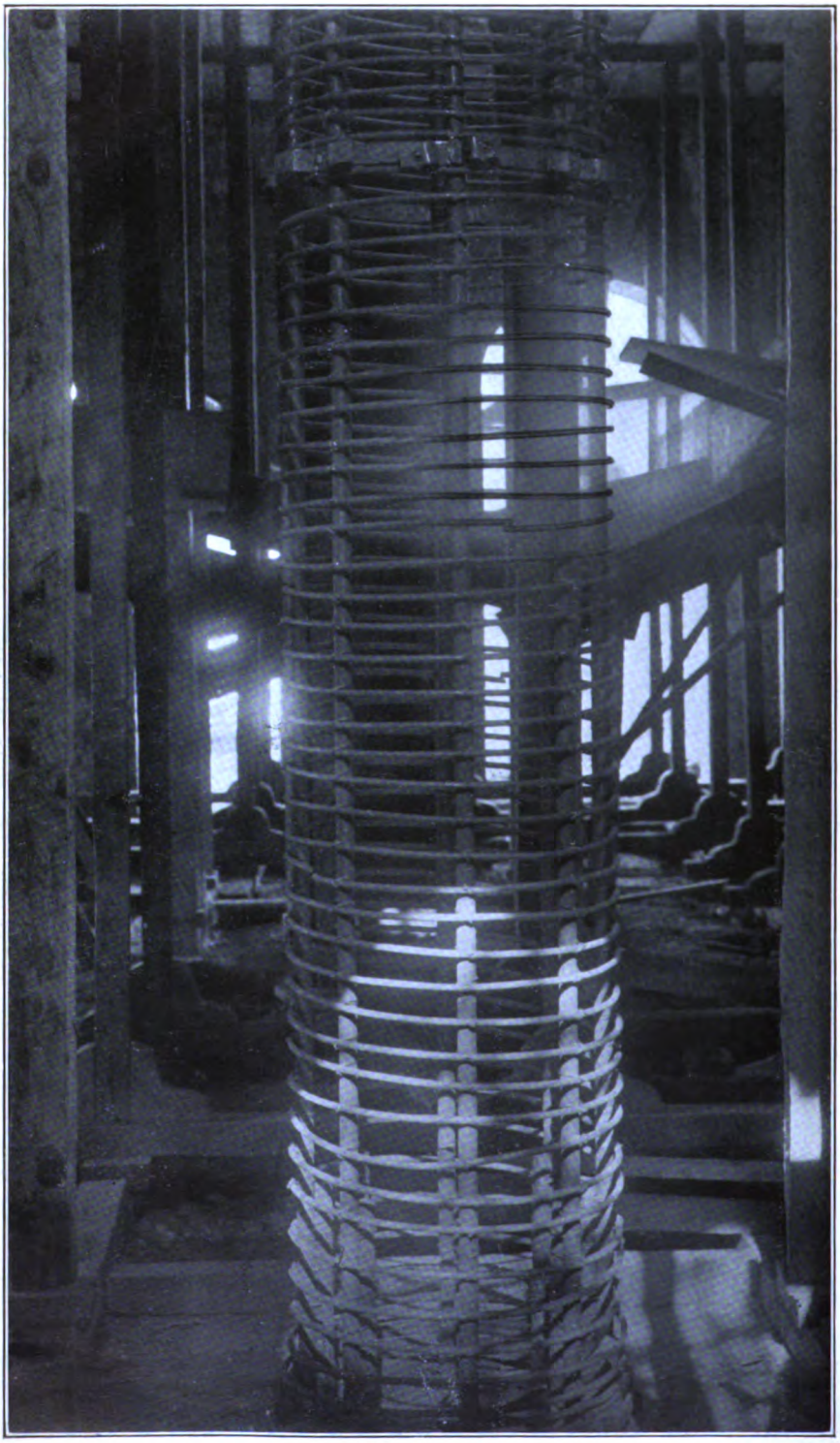
CONSTRUCTION OF A REINFORCED CONCRETE FLOOR, DALHOUSIE BAKERY.



A Pillar Reinforcement.

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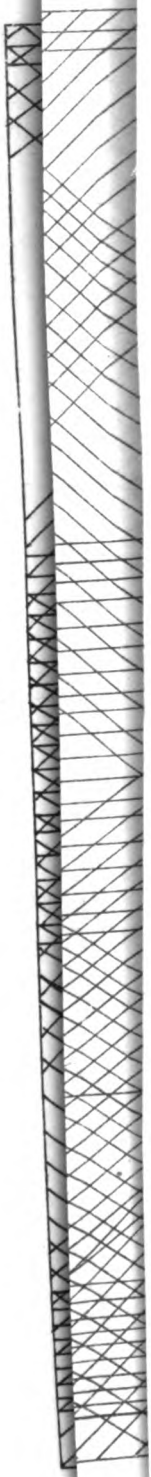

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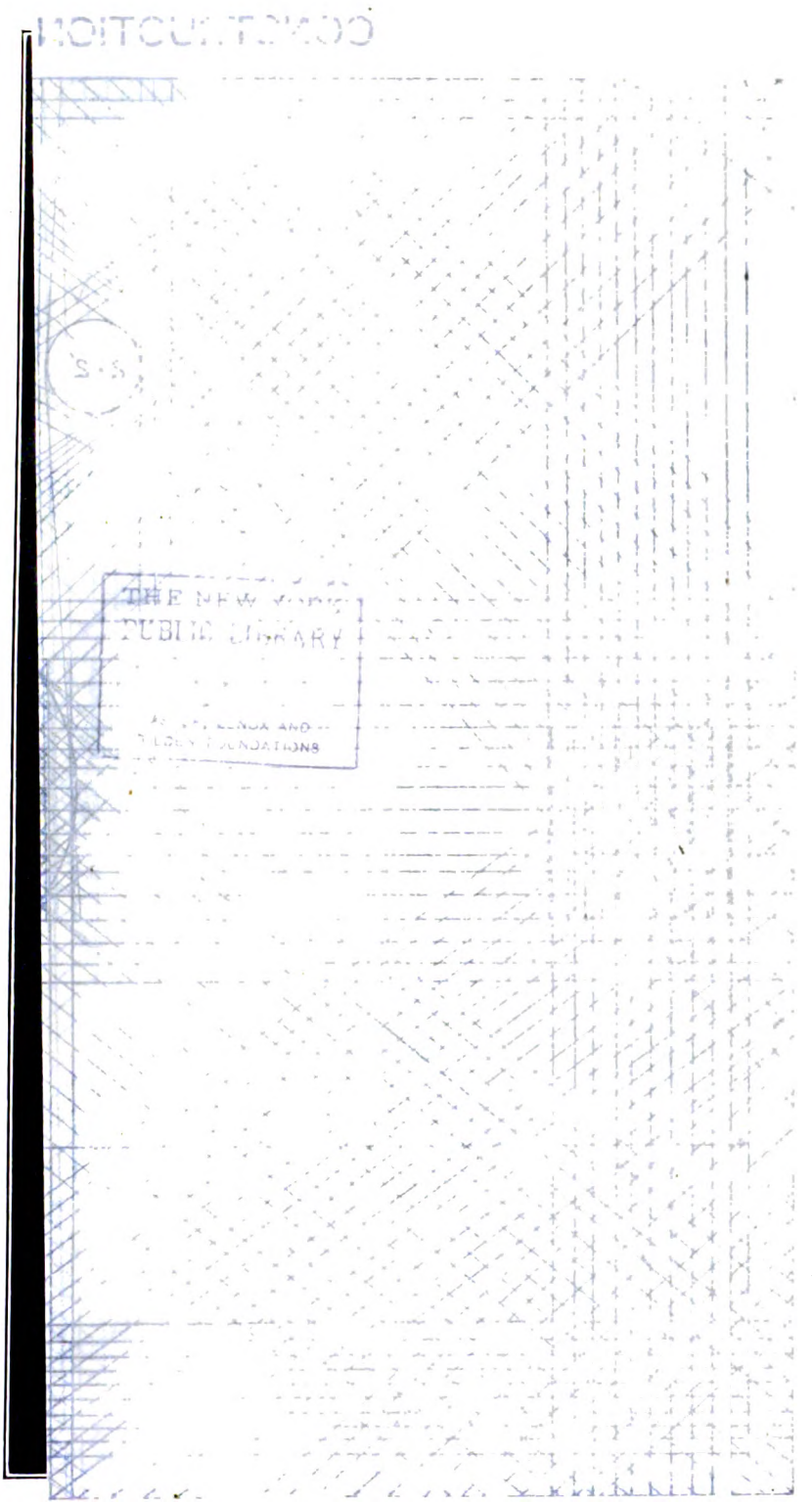

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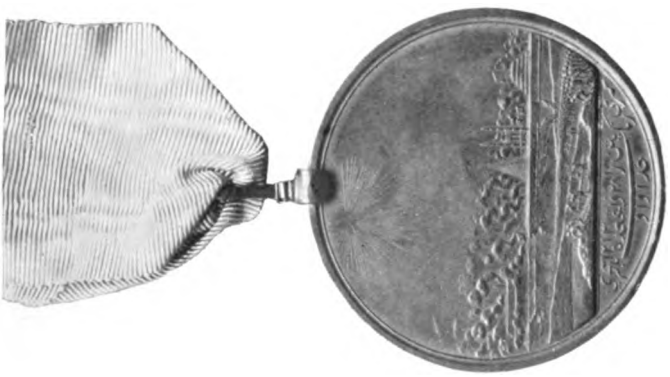
EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.



SERINGAPATAM. 1799.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

By MAJOR H. BIDDULPH, R.E.

THE following notes on the Early Indian Campaigns and the decorations awarded for them, were compiled by the writer as so little information seems to be available on the subject. That which exists, also, is very inaccurate. This is probably due to the fact that information as to the Native Corps engaged in battles many years ago is not very accessible; while the renumbering of the Indian armies in 1824, when the regiments were broken up into single-battalion regiments, followed by the Mutiny, which swept away most of the Bengal Army, and led to another renumbering of the corps that survived, complicated the matter still further. The period covered is 50 years, viz. 1799—1849. The medals issued by the H.E.I.C.S. to its native troops only have not been dealt with in detail. To have included the Indian Mutiny would have doubled the article; it is estimated that some 300,000 medals in all were issued for that campaign, the vast majority being without a clasp, or issued to native troops and local and irregular corps of every sort and description. It is not generally known, however, that at least 49 Europeans and 79 Natives earned the Mutiny medal with four clasps—the late Dr. Buick had two of these medals in his collection.

MYSORE, 1780–99.

No less than three wars were waged by the H.E.I.C.S. against Hyder Ali and his son Tippoo Sahib, successive rulers of Mysore. The first war, 1780–4, is notable for the defeat of Colonel Baillie, the defence of Wandewash (commemorated on the colours of the Dublin Fusiliers) and the Siege of Cuddalore, when the original 24th Bengal Native Infantry defeated the French European troops at the bayonet's point, taking prisoner the Chevalier de Damas and Sergeant Bernadotte, better known in later years as the King of Sweden.

The second war 1790–2 was undertaken by Lord Cornwallis in person, as the opening phase of the campaign was mismanaged by the local commander-in-chief. Bangalore was stormed and taken on the night of 21st March, 1791, and the army advanced on Seringapatam, defeating Tippoo at Arikera, a few miles from his capital. At the end of May just before the arrival of the force co-operating from the Bombay side under Major-General Robert Abercromby, Lord Cornwallis ordered a retreat on account of the abnormal rains,

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and the consequent loss of transport and failure of supplies. In the ensuing cold weather Cornwallis marched once more on Seringapatam and on the 6/7th February was fought the great battle on the island, which ended finally in the complete defeat of Tippoo, who lost 76 guns and some 20,000 men. Among the killed was Lieut. Patrick Stewart, Bengal Engineers. Tippoo then sued for peace, which was granted on his agreeing to cede an enormous tract of his territory and the payment of a war indemnity of 33 million rupees (about £4,000,000 stg.).

For both these wars the H.E.I.C. granted medals, but to the *native* ranks only; the native officers receiving medals in gold or silver according to their rank, while native non-commissioned officers and men received similar silver medals of smaller size.

The third Mysore war was undertaken in 1799, the chief command being vested in Lieut.-General George Harris, while a force under Lieut.-General Jas. Stuart co-operated from the Bombay side. This campaign is notable as being the first occasion on which the future Duke of Wellington, then Colonel the Hon. A. Wellesley saw service in the field. He commanded the Nizam's detachment to which his regiment, the 33rd Foot, was attached. The Madras and Bombay columns met with little opposition and concentrated beneath the walls of Seringapatam early in April, 1799.

The siege was commenced. On the 4th May the breach was stormed at midday, and Tippoo fell in the assault.

No less than 934 guns, howitzers and mortars were captured with the fortress; and the prize money amounted to £1,143,216, probably a record for British troops. A special medal was granted by the Company to *all* ranks; general officers receiving it in gold, field officers in silver-gilt, other European officers in silver, British sergeants and drummers in copper-bronzed, as also Native officers, havildars and drummers of the Madras and Bombay Armies, while inferior ranks received it in grain tin.

The die was copied in Calcutta and the Bengal Government following their usual practice, issued gold medals to the native officers, and silver medals to other native ranks of the Bengal native troops present at the siege.

A detailed list of the troops engaged is appended, together with a description of the medals issued and notes thereon. It was not until 1851 that the *Queen's* troops received official sanction to wear this medal on all occasions.

SERINGAPATAM, 1799.

(*a*). English Die; 1·9 in. diameter.
Gold, silver-gilt, silver, copper-bronzed, tin.

(*b*). Calcutta Die; 1·8 in. diameter.
Gold, silver.

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Obverse.—A tiger struck down by a lion; inscription in Arabic "The conquering Lion of God." "iv. May, MDCCXCIX."

Reverse.—The storming of the breach at midday.

Persian inscription in exergue "The God-granted Fortress of Seringapatam, 4th May, 1799."

Ribbon.—Watered yellow, or crimson with blue edges, 1¾ in. wide.

N.B.—The inscriptions on the medal have a double meaning: "The conquering Tiger (Lion) of God" was one of Tippoo's attributes; but in this instance is applied to the British Lion instead of to Tippoo's Tiger; while the phrase "The God-granted Fortress of Seringapatam" which here signifies the conquest of it by the British, signified previously to Tippoo's subjects that his sovereignty over Seringapatam was of Divine origin, both phrases being customary ones of Tippoo's.

The Medal for the Capture of Seringapatam, 1799, etc.

Much difference of opinion has prevailed as to the ribbon actually worn with the Seringapatam medal. That it was intended to be orange-coloured admits of no doubt, the statement on this point of General Sir J. L. Caldwell, Madras Engineers, (who received the medal) cannot be traversed. As, however, no ribbon was issued with the medal, everybody entitled to wear it had to provide it for themselves, and it is certain that a very large number of officers wore it suspended from the broad crimson and blue ribbon worn with Peninsula gold medals, which was the "military" ribbon of Great Britain. Examination of portraits, engravings, etc., show that Lord Harris, Sir David Baird, Sir Thos. Munro, Lord Combermere and others wore it in this way, some round the neck and others at the button hole; and it has been denied that the orange ribbon was worn by anybody. This, however, can be disproved, portraits of Sir John Malcolm and of Sir Robert Sale show distinctly the orange ribbon. Sir John Malcolm, who served as a captain at the siege in command of the Nizam's contingent, died in 1833, his portrait shows him wearing the gold or silver-gilt medal with an orange ribbon. Sir R. Sale served as a subaltern in the 12th Foot at Seringapatam, and his portrait as a Major-General appears to have been taken when he was at home on leave in 1844, after the close of the Afghan War. He is depicted wearing the Seringapatam medal with orange ribbon, the Ghuznee, Cabul and 2nd Jellalabad medals. The addition by the recipient of a heavy clasp, in gold or silver, inscribed "Seringapatam," was not uncommon in the case of officers.

With regard to the issue of the medal, it is to be noted that it was given not only as a war medal to the troops engaged at the siege or in the neighbourhood, but also as a commemorative medal to various personages and officials of high rank, and also to at least one military officer who was not present, viz. :—Major-General John Braithwaite, Adjutant-General, Madras Presidency. This fact detracts consider-

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ably from the interest attaching to all medals issued by the H.E.I.C. for various services ranging from 1778—1826, as one can very rarely be certain that any individual medal was actually worn by a soldier, and still less often as to who (if any) the wearer was. Re-strikes also, of all these medals, except that for Ava, are not uncommon. The dies of the Ava medal are at the Royal Mint, and re-strikes do not exist except the few issued as specimens with representative sets of medals; but original silver proofs perhaps exist. The dies of the Seringapatam medal, English die, are in private hands, and those of other medals at the Calcutta Mint; as it is only within the last few years that the Calcutta Mint has been prohibited from issuing re-strikes, they are by no means uncommon.

The Egypt (1801), Java and Nepaul dies are now cracked, and specimens showing these flaws are sometimes seen.

The dies of the 1784 Carnatic medal (commonly but erroneously called the Deccan medal), and of the Mysore medal, 1791–2, are not in existence; but castings are met with.

Medals from the Calcutta-made Seringapatam dies were struck in gold and silver for the Natives of the Bengal troops that served at the siege, Native officers receiving the gold medal, and other ranks the medal in silver. The Bengal troops present consisted of four companies of Bengal Foot Artillery and eight companies of Lascars, the 1st and 2nd Battalions of the 10th Bengal Infantry, and the 1st, 2nd and 3rd Volunteer Battalions from Bengal; after the war the 18th and 19th Regiments of Bengal N. Infantry (each of two battalions) were formed from these three Volunteer battalions.

The Seringapatam medal was the only one of this series that was issued to Europeans, with the exception of one gold medal presented to Sir Archibald Campbell, Commander-in-Chief of the expedition to Ava, 1824–26, and for this reason it has been discussed somewhat fully.

Troops engaged at

(1). *Siege and Capture of Seringapatam*, 1799.

Commander-in-Chief:—Lieut.-General G. Harris.

Madras Troops.

Cavalry:—Major-General J. Floyd, 19th Light Dragoons.

1st Brigade:—*Colonel J. Stevenson, 4th Madras Cavalry.
H.M. 19th Light Dragoons (430 men).
1st and 4th Madras Cavalry.

2nd Brigade:—*Colonel J. Pater, 2nd Madras Cavalry.
H.M. 25th Light Dragoons (454 men).
2nd and 3rd Madras Cavalry.

* Both these officers entered the H.E.I.C.S. from that of the Nawab of Arcot as Captains in 1784. They both attained General Officer's rank. Stevenson served with Wellesley in 1803–4.

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Guides :—Major J. Campbell.
Artillery :—Major-General D. Smith, Madras Artillery.
1st and 2nd Battns. Madras Artillery.
1 Co. Coast Artillery (serving with Nizam's detachment).
*3-1st, †5-2nd, 1-3rd and 2-3rd Battns. Bengal Artillery, and 8 Companies Lascars.
Engineers :—Colonel W. Gent, Madras Engineers.
Corps of Pioneers.
Infantry :—Right Wing :—Major-General T. Bridges, 1st Madras N.I.
1st Brigade :—Major-General D. Baird.
H.M. 12th Foot (693 men).
„ 74th Foot (789 „).
„ Scotch Brigade (559).
3rd Brigade :—Colonel F. Gowdie, Madras N.I.
1-6th, 1-12th and 1-1st Madras N.I.
5th Brigade :—Colonel G. Roberts, Madras N.I.
2-3rd, 1-8th and 2-12th Madras N.I.
Left Wing :—Major-General W. Popham, 7th Bengal N.I.
2nd Brigade :—Colonel J. C. Sherbrooke, 33rd Foot.
H.M. 73rd Foot (746 men).
‡Swiss Regiment de Meuron (715 men).
4th Brigade :—Lieut.-Colonel J. Gardiner, 1-4th Bengal N.I.
§1st, 2nd and 3rd Volunteer Battalions from Bengal.
6th Brigade :—Lieut.-Colonel T. Scott, Scotch Brigade.
2-5th and 2-9th Madras N.I.

Nizam's Detachment :—

¶Colonel the Hon. A. Wellesley, 33rd Foot.
H.M. 33rd Foot (879 men).
1st and 2nd Brigades :—Lieut.-Colonel J. Dalrymple, Madras N.I.
1st Brigade :—Lieut.-Colonel L. Grant, 10th Bengal N.I.
1-10th and 2-10th Bengal N.I.
2-11th Madras N.I.
2nd Brigade :—Lieut.-Colonel T. Bowser, Madras N.I.
2-2nd, 2-7th and 1-11th Madras N.I.

* The 3-1st Bengal Artillery served with the Nizam's detachment.

† The 5-2nd Bengal Artillery served with Colonel A. Brown's force; having recently come from Ceylon.

‡ The Regiment de Meuron was originally in Ceylon in the pay of the Dutch. On the capture of that island by the British it accepted service under the Crown, and was removed to India.

§ The three Volunteer Battalions from Bengal were formed of volunteers from every regiment in Bengal except the 10th Regiment, Bengal N.I.

¶ Later 1st Duke of Wellington.

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Artillery :—Major R. Howley, Madras Artillery.
3-1st Bengal Artillery.
1 Company Coast Artillery.
Lascars.
Nizam's Infantry (with guns) :—*Capt. J. Malcolm, Madras N.I.
4 Battalions of Infantry (the old French contingent, 3,600 strong, to which two troops of disciplined cavalry were attached).
Nizam's Cavalry :—Mir Alam. 6,000 strong.

Bombay Troops.

Commander-in-Chief :—Lieut.-General Jas. Stuart.
Artillery :—Lieut.-Colonel G. A. Lawman, Bombay Artillery.
3rd, 4th and 5th Companies.
Engineers and Pioneers :—Colonel J. C. Sartorius, Bombay Engineers.
Infantry :—†Major-General J. Hartley, 75th Foot.
Right Brigade :—Lieut.-Colonel J. Montresor, 77th Foot.
1-2nd, 1-4th and 1-3rd Bombay N.I.
Centre Brigade :—Lieut.-Colonel J. Dunlop, 77th Foot.
H.M. 75th Foot (223 men).
The Bombay European Regiment (528 men).
H.M. 77th Foot (693 men).
Left Brigade :—Lieut.-Colonel J. Wiseman, Bombay European Regiment.
2-3rd, 1-5th and 2-2nd Bombay N.I.

(N.B.—The 2-3rd Bombay N.I. had detachments from other regiments).

On the 1st April, 1779, Major-General Floyd was detached with all the regular Cavalry and the 3rd Infantry Brigade (Gowdie) to meet a convoy under Colonel A. Read. Read met Floyd at Cowdahully at the end of April, was joined by Colonel Brown's detachment on the 6th May, and the whole force returned to Seringapatam with the convoy on the 11th May.

Colonel A. Read, 2-4th Madras N.I.

Capt. M. Cosby's Troop.
6 Troops Nizam's Horse.
Madras Artillery (36 men).
Nizam's do.
1st Madras European Regiment (69 men).
Convalescents H.M. Foot (40 men).

* Afterwards Sir J. Malcolm, G.C.B.

† Hartley was transferred as a Lieut.-Colonel from the Bombay Army to the Lieut.-Colonelcy of H.M. 75th Foot, when that regiment was raised for service in India in 1787.

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Flankers 1-4th Madras N.I.
do. 1-5th Madras N.I.
Battn. Companies 2-4th Madras N.I.
Nizam's Infantry.
Pioneers.
In all 5,280 men.

Lieut.-Colonel A. Brown, Madras Infantry.

5-2nd Bengal Artillery (44 men).
Madras Artillery (55 men).
5 Companies H.M. 19th Foot (386 men).
Madras European Regiment (617 men).
Bengal Lascars.
Madras do.
New Troops N. Cavalry.
3 Companies 2-1st M.N.I.
Battn. Companies 1-2nd M.N.I.
„ „ 1-3rd M.N.I.
Flankers 2nd and 3rd Regiments, M.N.I.
Flankers 13th Regiment, M.N.I.
Pioneers.
In all 4,300 men.

Both these detachments shared in the prize money, the estimated total value of which was £1,143,216; and although not actually present at the siege it is probable that they were granted the medal also.

(2). *Assault of Seringapatam, 4th May,* 1799.

Major-General D. Baird in command of the assaulting column.

Right Column :—Colonel J. C. Sherbrooke.
Flankers, Scotch Brigade.
do. Regiment de Meuron.
H.M. 73rd and 74th Regiments.
Flankers, 2-2nd, 2-3rd, 1-11th and 2-12th Madras N.I.
do. 1-2nd, 2-2nd, 1-3rd, 2-3rd, 1-4th, 1-5th Bombay N.I.
50 Gunners and Lascars.

Forlorn Hope :—*Lieut. V. Hill, 74th Regiment, with 1 sergeant and 12 men, supported by 25 men.

Left Column :—Lieut.-Colonel J. Dunlop.
Flankers, H.M. 75th, 77th and Bombay European Regiment.
H.M. 12th and 33rd Regiments.
Flankers, 1-10th, 2-10th Bengal N.I., and the 3 Volunteer Battalions, Bengal N.I.
50 Gunners and Lascars.

* Killed in the assault.

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Forlorn Hope :—*Lieut. A. Lawrence, 77th Regiment, with 1 sergeant and 12 men, supported by 25 men.

Half the corps of Pioneers accompanied each column.

The casualties during the siege were :—

Officers ...	22 killed.	45 wounded.	
Europeans ...	181 „	624 „	22 missing.
Natives ...	119 „	420 „	100 „

934 guns, howitzers and mortars were captured with the fortress.

ENGINEER OFFICERS WHO SERVED IN THE MYSORE WARS.

1ST MYSORE WAR, 1780–4.

Only Madras Engineers employed.

1780.—*With Colonel Baillie's Force.*

Capt. Jno. Theobald, killed at Perambankum, 10. 9. 80.
Ensign — Brunton, taken prisoner, and died in Seringapatam.

1781–2.—*With Sir Eyre Coote's Army.*

Capt. Alex. Dugood, killed at Chittoor, 10. 11. 81.
„ Jas. Johnston, at Negapatam in 1782.
„ Wm. Gent.
Lieut. Jno. Wickens, to Negapatam 24. 9. 81, with Coote in 1782.
Ensign Rd. Baker.
„ Chas. Parsons Ogg.
„ Geo. Bong, sent to destroy Fort Pulicat, December, 1781.

1781–2.—*With the Southern Army.*

†Major Thos. Geils, Chief Engineer; at Siege of Negapatam and Trincomalee.
Lieut. Jno. Wickens, at Siege of Negapatam.
„ Chas. Salmon, A.D.C. to Colonel Jno. Braithwaite, 13. 2. 82.

Capitulation of Trincomalee, 30. 8. 82.
- Capt. Geo. Banks, to Trincomalee from Trichinopoli, 30. 7. 82.
- Ensign Rob. Watson, „ „ Negapatam, 30. 7. 82.
- „ Crawford Lennox, „ 30. 7. 82.

Ensign Wm. Collins Tyson, to Negapatam vice Watson, 30. 7. 82.

* Father of Sir H. M. Lawrence.

† [Lieut. Thos. Geils, Madras Artillery, served with the Engineers from 1768–87, when he returned to the Artillery as Lieut.-Colonel and Commandant. A MS. *Army List* of 1787 shows him as Major of Engineers and Lieut.-Colonel Commandant of Artillery, his name being entered in the lists of both corps.]

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1783.—*With Major-General Jas. Stuart's Army.*

*Lieut.-Colonel Pat. Ross, Chief Engineer.
Capt. Jas. Johnston.
„ Geo. Banks.
Lieut. Jno. Wickens, A.D.C. to Chief Engineer.
Ensign C. P. Ogg.
„ Jacob Hemming.
„ Dan. Jennings.
„ Jno. Norris.
„ Sam. Saunter.

1783.—*With the Southern Army.*

Capt. Jno. Byres or Bryres, from July, 1783, as Chief Engineer.
Lieut. Chas. Salmon.

2ND MYSORE WAR, 1790–2.

Bengal Engineers.

S. Capt. Alex. Kyd, A.D.C. to Lord Cornwallis.
S. Lieut. Pat. Stewart, killed 6. 2. 92 at Seringapatam.
S. Ensign Jos. Stokoe, commanding Pioneers.
S. „ Jas. Tillyer Blunt.
S. Two other officers, names unknown.

Madras Engineers.

S. Lieut.-Colonel Pat. Ross, Chief Engineer.
B. Major Geo. Maule, Chief Engineer.
Capt. Elisha Trapand, to Tanjore, G.O., 11. 5. 91.
„ J. A. Kissellbeck, to Vizagapatam, G.O., 31. 8. 91; died 24. 5. 92.
B. „ C. P. Ogg, to Ganjam, G.O., 31. 8. 91. To Trichinopoli, G.O., 15. 2. 92.
Lieut. Wm. Wynn Ryland; sick 6. 11. 90; died 12. 6. 91.
„ Geo. Bong.
S. „ Jacob Hemming; wounded 6/7th February, 1792.
S. „ Mich. Russell, Adjutant, vice Cree, killed.
B.S. „ Jno. Norris.
B.S. „ Walter C. Lennon, commanding Pioneers.
B.S. „ Colin Mackenzie, A.D.C. to Lieut.-Colonel P. Ross.
B. Ensign Alex. Cree, Adjutant, killed at Ryacottah, July, 1791.
„ David Barclay, died at Trichinopoli, 9. 7. 90.
B. „ Geo. Johnston, to Coimbatore, end of 1791.
B.S. „ Thos. Wood, from September, 1790.

* N.B.—When the Corps of Madras Engineers was put on a purely military basis, and reorganized, 15th September, 1770, Capt.-Lieut. Pat. Ross of the Royal Engineers was brought out from England as Chief Engineer, with the rank of Lieut.-Colonel.

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B.S. Ensign Jas. L. Caldwell, twice wounded.
B.S. „ Jno. W. Pyefinch.
S. „ G. C. G. Pittman.
S. „ Wm. Farquhar.

Bombay Engineers.

S. Major J. C. Sartorius, Chief Engineer with Major-General Robt. Abercromby.
S. Capt. Wm. H. Blackford, wounded.
Lieut. Fras. Stuart, killed at Dharwar, 14. 1. 91.
S. Ensign Jno. Johnson, with Little's detachment.
Three other officers, names unknown.

B. *Signifies engaged in the Bangalore Campaign.*
S. „ „ *Seringapatam Campaign.*

3RD MYSORE WAR, 1799.

Madras Engineers.

Colonel Wm. Gent, Chief Engineer.
Major Elisha Trapaud.
Capt. Jno. Norris, A.D.C. to Chief Engineer.
„ Colin Mackenzie, Chief Engineer, Nizam's detachment.
„ Geo. Johnston.
Capt.-Lieut. Jas. L. Caldwell, twice wounded.
„ Jno. Blair.
Lieut. Wm. Castle.
„ Thos. Fiott d'Havilland, with Brown's detachment.
„ Jno. Cotgrave.
„ Ben. Sydenham.
„ Jno. Ross Cleghorn.
Ensign Thos. Fraser, adjutant, wounded at Malavelly, 27. 3. 99, later with Read's detachment.
Thos. Arthur.
Wm. Gerrard.
Geo. Rowley.
Ensign Edw. Malton.
„ Chas. W. Bell.*
„ Jno. Smith.

Bombay Engineers.

Lieut.-Colonel J. C. Sartorius.
Ensign Jno. Johnson.

* [N.B.—Ensign C. W. Bell was transferred to the cavalry permanently on 28. 6. 01 and served with the 6th Madras Light Cavalry at Asseerghur, Argaum and Gawilghur in 1803.]

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REVIEWS.

LES AÉROPLANES DANS LA GUERRE D'AUJOURD'HUI.

By LIEUT. DE BOISRICHEUX.

Paris, 1913: *Librarie Chapelot.*

THE writer sets out to answer the following questions; what advantages the commander will obtain from these new auxiliaries, and what strategical and tactical consequences will result from their employment.

He divides aeroplanes into four classes, for reconnaissance, for communication, for combat and for observation, especially in connection with artillery.

The question of transport is discussed, also means of transmitting information, security against rifle and gun fire, the employment of aeroplanes with cavalry, and their uses as means of communication.

In the combat they can be used to drop bombs, or can be fitted with automatic rifles or small-bore guns. They can be used to frighten the enemy's cavalry and so interrupt his charges.

Excellent results have been obtained by siege guns directed from aeroplanes, and their observations should save field artillery the waste of many rounds. Several methods of communicating with the batteries are described.

A few remarks are made on organization for the various functions mentioned above.

The conclusions are that aeroplanes will be most annoying to the enemy, of invaluable assistance to the reconnoitring cavalry, and will have great influence on the moral and leading of the troops. The C.-in-C. and his staff must realize that the least mistake or hesitation may be noticed and put to profit by the enemy. The soldier must be imbued with greater courage and indifference to death, for he will find his weapons of little use in protecting him against his new antagonist.

A.R.R.

FEUILLES DE ROUTE BULGARES.

By ALAIN DE PENENNRAU.

Paris, 1913: *Librarie Chapelot.*

THE author gives an interesting description of his journey from Paris to Sofia, and thence through Thrace in rear of the Bulgarian Army in October and November, 1912. He first tried to join the 2nd Army before Adrianople, but finding the censorship too strict moved off to

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join the 3rd Army. With the latter he had slightly better success and describes from hearsay the Battle of Kirk Kilisseh (Bulg. Lozengrad). The Turkish repulse here seems to have degenerated into a demoralized rout, and the stores of all descriptions abandoned were estimated at 10 millions of francs in value. The Bunar Hissar road as far as Jana was littered with military stores. The battle on the line Bunar Hissar—Lule Burgas is described from hearsay. It was only in front of the Chatalja lines that the author saw any fighting. Here the excitement and dash that had carried the Bulgarians to victory was exhausted, dysentery was decimating their ranks, possibly diplomacy was calling for a halt, or the capture of Adrianople was assuming a more important aspect.

Whatever the cause, insufficient weight was put into the attacks on the Lines, the Turks behind earthworks and nearer their sources of supply had regained heart, and the Bulgarian advance was checked.

The conduct of all ranks and arms in the Bulgarian Army must have been most praiseworthy to have so far triumphed over difficult country, the almost entire absence of roads, and the bad weather. Sanitation in camp however was practically *nil*, though the hospitals were well organized.

The author paid another short visit to the investment of Adrianople on returning. For a study of the strategy and tactics of the campaign the book is of no value, as no details of that nature could be obtained.

A.R.R.

LA GUERRE EVENTUELLE.

By LIEUT.-COLONEL A. GROUARD.

Paris, 1913: *Chapelot.*

THIS is a very careful study of the strategy which the author considers France should employ prior to, and during the commencement of, the war with Germany which he looks upon as inevitable.

The first chapter is devoted to a general description of the military frontiers between the two nations, and of the part to be played by the various fortified positions on either side, whether in attack or defence.

The conclusion arrived at, in the case of a war between France and Germany alone, is, that the latter will at first be the attacking party, and that France may have to give way for a time. In any case the author does not recommend that France should be in a hurry to attack. If she did so and were victorious her further advance should be very deliberate, and each zone of captured territory would have to be carefully occupied.

The author criticizes some recently published works on the same theme, *La France victorieuse dans la guerre contre Allemagne* and *L'Offensive contre Allemagne*, by Colonel Boucher, also *La doctrine de defense nationelle*, by Capt. Sorb. He considers these to be much too sanguine, and the conclusions arrived at to be deduced from false data. He argues that France has the advantage of starting from

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interior lines, points out how this advantage should be utilized if the fullest benefit is to be derived from it, and how the German attack could best be met and checked.

Some trenchant remarks are made in regard to the higher command of the French Army, and to the necessity for the Commander-in-Chief to be freed from civil control.

An appendix is added, written since the commencement of the Balkan War, pointing out how the situation might be modified in the event of a general European conflict. Even if Germany were engaged in war on one of her other frontiers, an advance into German territory would be attended with risk. A vigorous offensive is advocated on a portion of the line, and the necessity for making good all conquest is again drawn attention to.

The book is exceedingly interesting and well worth study, but is not too flattering to our neighbours! "Amour propre."

A.R.R.

LA GUERRE TURCO-BALKANIQUE, 1912.

By LIEUT.-COLONEL BOUCABEILLE.

Paris, 1913: *Chapelot.*

AN interesting and useful account of the principal events of the war. The work opens with a short geographical and political sketch of the countries concerned. The normal composition, organization, and mobilization arrangements of each of the armies is briefly stated. Part II. comprises the operations of the Greek Armies, Part III. those of the Montenegrins, Part IV. the Servian and Parts V. and VI. the Bulgarian. A separate chapter is devoted to the maritime operations. Some remarks are then made on the probable causes of the Turkish defeat, and the book ends with a comparative statement, in chronological order, of the operations of the allies. There are 11 maps, and 10 sketches in the text, illustrative of the country and the most serious engagements.

A.R.R.

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NOTICES OF MAGAZINES.

REVUE D'ARTILLERIE.

January, 1913.

THE MILITARY VALUE OF AVIATION.

A lecture given by Colonel J. E. Estienne, of the Artillery. His conclusions are that light, easily transported, single-seated aeroplanes, built to rise quickly rather than to travel far, will always be of great use to officers of all arms, especially to the cavalry, as they meet the tactical need of enabling one to rise to see better. Heavier machines as weapons of offence, unless they can be armed and armoured and provided with engines of great horse power, will not have great influence on the results of battles. Incendiary grenades might be useful, especially against airships.

CONTRIBUTION TOWARDS THE HISTORY OF THE ARTILLERY (*continued*).

Treats of the introduction of time and percussion fuzes, and of the difficulties encountered and met by degrees. Also of the opposition to rifled guns, one of the chief being that the shells would not roll, and their effect was too local. Case shot could not be used with them. Of considerable historical interest.

THE LIGHT HOWITZER.

Major Challéat, of the Artillery, discusses the question whether the French *corps d'armée* have need of these weapons, and in what proportion. He compares the French and German 75-m.m. and 77-m.m. guns, their numbers and employment and the effect of their shrapnel and high-explosive shell. He is against the proposal to use reduced charges and curved fire with the French gun. He then describes the characteristics and employment of the German 105-m.m. light howitzer firing the universal shell. This shell is used with time fuze as shrapnel, and as common shell with a percussion fuze, with or without delaying action. As he does not know the details of the German shell, he describes one patented in France by Messrs. Krupp.

His conclusions are that France also ought to have a light howitzer, and makes suggestions as to the number required, the most suitable size of bore, and how the need could be met.

METHODS OF TESTING METALS, CONGRESS OF NEW YORK, 1912 (*continued*).

Section D. Various.—These extracts are not capable of much further condensation. The following are briefly the heads of the matters discussed:—

(1). Proposed uniform definitions for iron and steel of different qualities.

(2). General principles to be observed in selecting copper for mechanical and electrical constructions.

(3). Comparison of the magnetic and electrical properties of metals in relation to their behaviour during mechanical tests.

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(4). Application to cast iron of the methods of mechanical test adopted for other metals.

(5). Note on the resistance of cylindrical tubes up to the point of rupture.

The compiler of the extracts then proceeds to suggest the tests that would be of useful application in artillery laboratories.

Various Information.

The results of recent military aviation meetings in England and Russia are published in tabular form.

A description is given of the German Polte cartridge. Part of the charge is made in the form of a sausage with constrictions at intervals. The portions between the constrictions are numbered. Normally the full charge is inserted, and if a reduced charge is required one section or more is withdrawn through the hole for the cap in the base of the cartridge, and cut off at the required constriction. The inverse method is possible however, and extra sections can be inserted.

February, 1913.

Some Lessons from the Balkan War on the Tactical and Scientific Employment of Artillery.

An article by General Herr, who visited the Servian lines at Uskub and Kumanovo, and the Turkish position at Chatalja, and who is thus able to compare the sometimes contradictory accounts of the two opposing sides on actual occurrences of the war. This is the first occasion on which the opposing troops have both been armed with the most recent guns, the Turks possessing German weapons and having been trained on the German model, the Allied Powers being French trained, and with weapons similar to those of the French artillery.

At Komanovo the Servian guns at once opened fire on the Turkish guns, which had been placed in the open to fire on the Servian infantry. The latter were soon reduced to silence and the Servian guns could attack the Turkish infantry without being molested themselves. Three batteries of Turkish guns later opened fire on the Servian flank attack. Two in the open were at once annihilated, the third battery, masked even to its flashes, escaped injury and decimated the Servian infantry by oblique fire, until the Servians brought an overwhelming cross fire to bear on it.

Conclusions.—1. (*a*). In spite of shields and of being in a covered position, a battery can be destroyed and not only neutralized.

(*b*). Wounds caused by shrapnel balls take longer to heal than those caused by the rifle. The artillery fire disabled more men than the rifle.

2. The artillery duel is still necessary.

3. Oblique fire is very deadly, the one covered Turkish battery checked the whole Servian flank attack.

4. The Servians only fired 120 rounds per gun, but as the Turkish guns were in the open this gives no idea of what the expenditure of ammunition would have been had the Turkish guns been masked.

(*a*). The Servians ranged on a large number of points and were able to seize fleeting opportunities for inflicting loss.

(*b*). The Servian officers consider that, in spite of knowing these

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ranges, the expenditure of ammunition would have been much greater had they not had observing ladders close to their batteries. No time was thus lost in observing the results of fire, and correcting the fire thereby.

At the Battle of Monastir the following particulars were gleaned:—

1. The Servian heavy artillery was most effective at 8 kilometres (5 miles) and the Turks could not reply to it.

2. A Servian division was caught on a bridge between the cross fire of two groups of Turkish guns, and could only be freed by the Servian heavy guns which opened oblique fire at 10 k.m. on the two Turkish groups.

3. After the duel against the Turkish artillery marked by such incidents as above described, the Servian artillery acquired a definite superiority and their infantry attacks could be pushed home.

4. The Servians used their mountain artillery to accompany their infantry advance.

Conclusions.—1. The artillery duel is still necessary.

The adversary who has heavy artillery can by degrees reduce his opponents' field guns to silence, while the latter cannot reply and are hindered in their attack on the adversary's field artillery. Mountain artillery owing to the facility with which it is transported can accompany infantry, its use in broken country is clearly indicated, and it can take cover and fire from behind steep slopes.

The Bulgarian artillery was very ineffective against the lines of Chatalja. The Turks attribute this to the fact that the shells were burst too high. Fuzes picked up were set to 5,600 and 5,800 metres. At such ranges field artillery fire can only be effective if burst with great accuracy. Owing to the small effect of the Bulgarian shells the Turks had virtually the superiority in artillery and could use two arms against one.

An attack in front over open ground is assured of success if a definite superiority is first acquired over the enemy's artillery. The Bulgarian field artillery could not advance under cover to within effective range. Heavy guns are necessary in such cases. High-explosive shell are required to silence guns in pits.

At 1,500 metres, owing to their flat trajectory, the Turkish guns had no effect on the *personnel* in trenches straight in front of them. Oblique and flank fire is necessary.

From the above General Herr deduces that the French *corps d'armée* should have long range guns of a calibre of about 100 m.m. He advocates the "universal" shell adopted by the Germans for their 105-m.m. howitzer. Aeroplanes should be detailed for the exclusive use of the artillery. Observing ladders and range finders are most necessary. Teams cannot be hooked in under fire, some arrangement is required to enable the positions of guns to be changed easily by hand.

The regulations direct that artillery fire should at first be divided between the enemy's artillery and his infantry. This is wrong, and should be altered, fire must first be concentrated on the artillery. Scientific methods of fire against infantry require to be explained in more detail in the Regulations. The necessity for oblique fire should be more strongly insisted upon. The principles laid down as to the use of aeroplanes by artillery apply to individual batteries only. They must be extended to embrace their employment by larger units.

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Note on Firing from Well-Concealed Positions.

Many officers are led away by the advantages concealment seems to offer. Major H. Cédié argues that positions offering very considerable concealment will seldom be obtainable in war, or if obtainable will not be used owing to the delay caused in ranging. This particularly applies in a combat of encounter, good concealment will be more used in defensive actions than in any other.

The Firing Manual of the Russian Field Artillery.

This manual appeared in 1911 together with instructions on the application of the rules of fire. The changes introduced since the 1904 edition of the manual are commented upon. It is remarkable that ranging is to be carried out by the whole battery (eight guns). The rules for obtaining the direction seem complicated. Rules are given for laying on dirigibles.

Generally speaking the manual is based on the lessons of the Russo-Japanese War. The advantages of concealment and well-organized intercommunication are insisted upon. Only two rounds per gun rapid fire is allowed. Indirect laying is to be the normal method, and mere initiative is left to the battery commander.

A.R.R.

Rivista di Artiglieria e Genio.

January, 1913.

French Military Aeronautics.

Aerial navigation, under whatever form it may have assumed, but especially that of aviation, has developed greatly in these last years and is still on the increase. Under the title of "military aeronautics" an arm, formed with *personnel* of all the other arms, has arisen. Military aeronautics is concerned with the study of the acquisition and construction, and the placing in working order of all the means of aerial navigation for military purposes—balloons, dirigibles, aeroplanes, etc. To the War Minister is allotted a special section which, partly under the direction of the engineers, is called the aeronautical section, and which centralizes and studies all questions relating to military aeronautics, *personnel*, material, and mobilization.

Military aeronautics is placed under the authority of a general officer directly under the War Minister, who has the title of "permanent inspector of military aeronautics." It comprises: (*a*) personal navigation; (*b*) aeronautical troops; (*c*) establishments. These elements are distributed in aeronautical centres.

(*a*). Personal navigation is formed from officers and men of the troops recruited from the whole army and who are placed outside the lists. The numbers are variable and are determined by decree according to the funds available and the requirements for instruction. They are allotted to the several aeronautical centres, and divided into sections for aviation and the crews for dirigibles.

(*b*). Aeronautic troops comprise 7 aeronautical companies (4 for aerostation, and 3 for aviation) and 10 aeronautical sections, but this number may be increased as aviation progresses.

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1. *Transport Companies.*—These are divided into three groups each under the orders of a Lieut.-Colonel or Colonel. Each group contains companies and sections, either for aerostation or aviation or in various localities for both.

The following table shows the disposition of the aeronautical troops :—

Groups and Localities.	Troops.	
	Central Units.	Detached Sections.
1st Group, Versailles.	1st Aeronautical Company (aerostation). 2nd Aeronautical Company (aerostation). 3rd Aeronautical Company (aviation). 8th Transport Company.	11th Aeronautical Section (Chalais Meudon). 12th Aeronautical Section (Douai). 13th Aeronautical Section (Etampes).
2nd Group, Reims.	4th Aeronautical Company (aerostation). 5th Aeronautical Company (aerostation). 6th Aeronautical Company (aviation).	21st Aeronautical Section (Chalons Camp). 22nd Aeronautical Section (Verdun). 23rd Aeronautical Section (Toul). 24th Aeronautical Section (Epinal). 25th Aeronautical Section (Belfort).
3rd Group, Lyons.	7th Aeronautical Company (aviation).	31st Aeronautical Section (Campo d'Avon). 32nd Aeronautical Section (Pau).

One of the sections of the 1st group is at the disposal of the War Minister.

Aeronautical Centres.—The name of "Aeronautical Centre" is given to the locality where aeronautical services are collected under a central authority, who is called the "chief of the aeronautical centre." The aeronautical centres may be constituted with one unit of aerostation, with one unit of aviation, or with both. They arrange for professional instruction, and for the purchase, maintenance, and repairs of material.

Aeronautical Establishments comprise depôts for aeronautical material, offices, and special establishments.

The depôts and offices are found in all the principal and secondary centres, developed more or less according to the importance of the centre. They provide for the purchase, maintenance and repair of the material. They depend upon the chief of the centre under the direction of the Commandant of the group to which the centre belongs, thus:—Command of the 1st group—for the depôts and offices stationed in the military government of Paris, and the districts of 1st, 2nd, 3rd, 4th, 5th, 9th, 10th Army Corps, as well as the 11th Morocco, Tunis; command of the 2nd group—districts of the 6th, 7th, 20th Army Corps; command of the 3rd group, districts of the 8th, 12th, 13th, 14th, 15th, 16th, 17th Army Corps, as well as the 18th, 19th at Algiers. Each of the depôts and offices has its own specialized and administrative staff.

The special establishments depend directly upon the War Minister through the channel of the Inspector-General of Aeronautics, and comprise :—

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The direction of military aeronautical material;
The central establishment of military aeronautical material; } at Chalais
The laboratory for military aeronautics; } Meudon.
The atmospherical and telephotography laboratory;
The military aviation laboratory at Vincennes.

Peace Organization of the Companies and Aeronautical Sections.

	Aeronautical Companies.	Aeronautical Section.	Transport Companies.
Captains	1	1	1
Lieutenants and sub-lieutenants	2	—	2
Total officers	3	1	3
Adjutants	1	—	1
Sergeant-majors	1	—	1
Farrier-sergeants	1	1	1
Sergeants	9	2	10
Corporals	9	4	12
Chief workmen	5	2	—
Buglers and drummers	2	1	2
Privates	80	50	100
Total troops	108	60	127
Officers' horses	3	1	3
Troop horses	—	6	130

Peace Organization of the Aeronautical Groups.

		1st Group.		2nd Group.		3rd Group.		Note.
		Officers.	Troops.	Officers.	Troops.	Officers.	Troops.	
Staff of the groups.	Commandant (colonel or lieut.-colonel).	1	—	1	—	1	—	All the officers are mounted except the treasurer and the clothing officer. The commandant has 2 horses.
	2nd Commandant (lieut.-colonel or major).	1	—	1	—	1	—	
	Relatore (major or captain)	1	—	1	—	1	—	
	Officer in charge of mobilization (captain).	1	—	1	—	1	—	
	Treasurer (captain or lieutenant).	1	—	1	—	1	—	
	Clothing officer (captain or lieutenant).	1	—	1	—	1	—	
	Under officers, corporals and soldiers.	—	31	—	31	—	31	
Aeronautical troops.	Aeronautical companies(*a*)	9	324	9	324	3	108	(*a*). 3 to 1st group, 3 to 2nd, 1 to 3rd.
	Aeronautical sections (*b*)	3	180	5	300	2	120	(*b*). 3 to 1st group, 5 to 2nd, 2 to 3rd.
	Transport companies	3	127	—	—	—	—	
	Total men for each group	21	662	20	655	11	259	
	Horses	20	130	19	30	8	12	

The numbers indicated correspond to those up to the end of 1912. The number of sections varies with successive augmentations.

Administrative and Technical Organization.—For manœuvres and mobilization the units are divided into (1) squadrilla and crews for the dirigibles; (2) formations assigned for the service of captive balloons.

The commandant of the aeronautical centre is responsible to the commandant of the groups for the military and technical instruction and

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for the mobilization of all the effective aeronautical troops. He is also responsible for the depôts of aeronautical material. The effective officers of the companies and sections are charged with the administration of the units, and with their military and technical instruction.

The chief of aviation is concerned with aeroplanes, the organization of the squadrilla, and the instruction of the aviators. The chief of aerostation is concerned with the dirigibles, spherical balloons—both free and captive, kites and the instruction of the *personnel*.

AVIATION.—*Aeroplanes.*—The composition of this section is not precisely fixed and depends upon the future development of aviation. The decree of the War Minister authorizes that the normal squadrilla should consist of eight machines, divided into four sections each with two machines. The machine may be biplane, monoplane, or multiplane.

Each squadrilla is provided with automobile transport—12 autocars for each squadrilla, that is three per section, and an office wagon per squadrilla, two rapid motors for terrestrial communication. The *personnel* of a normal squadrilla consists of 7 pilots, and comprises the commandant, observers in various numbers, 1 accountant, 4 non-commissioned officers, 44 corporals and skilled privates, 2 non-commissioned officers and 14 unskilled soldiers. Provision is made for requisitioning private material in time of war and for the summoning of pilots.

At the end of 1912 it was intended that 27 squadrilla for the field, and 5 for fortresses should be mobilized, as well as 6 squadrilla for the surveillance of certain points on the coast, and 10 sections with a reserve machine for each section for the cavalry divisions. At the end of 1913 there should be 510 machines, and the ultimate programme is for a thousand or even more.

AEROSTATION.—*Dirigibles.*—These take part in manœuvres, and the commandant directs the instruction of the pilot pupils and the mechanics, under the authority of the chief of aerostation of the aeronautical centre. The *personnel* constituting the crew of a dirigible is taken from the aeronautical companies and sections stationed in the aeronautical centre. Trials are being made with a uniform type of dirigible *cruisers*, and there should be 20 of these by the end of 1915 (5 each year for 1912, 1913, 1914, 1915), which, together with 15 dirigibles now existing of divers types, will form the complete squadron according to the present programme. In war time private dirigibles will also be requisitioned to be used with the army.

Spherical Balloons.—Each aeronautical company has an aerostatic park, either for compressed or ordinary hydrogen. The park for compressed hydrogen is conveyed in 20 wagons (1 windlass car, 12 tube cars, 1 balloon car, 1 ammunition, 2 carbon, 3 provisions and baggage). The ordinary park consists of 16 wagons (1 for the manufacture of hydrogen, 1 windlass, 1 balloon car, 13 for tools, carbon and baggage). The organization for each park comprises 1 captain, 2 subalterns, 78 troops. Each park provides for 4 balloons—1 varnished spherical balloon of 540 m.c., 1 unvarnished balloon, 1 auxiliary balloon of 200 m., 1 balloon of 50 m.c. for transport of gas. There are also the necessary means for preparing 10 inflations.

The depôts of aerostatic material are at Versailles, the camp at Chalons, and at Reims.

E. T. THACKERAY.

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CORRESPONDENCE.

THE WATER SUPPLY OF RISALPUR.

DEAR SIR,

The article in the April number of the *R.E. Journal* on the Risalpur water supply might perhaps have been of still greater interest if it had gone rather more fully into the actual results obtained. It leaves one perhaps with the impression that the six wells give the required supply of 263,000 gallons. For the benefit of anyone who may have to undertake a similar project I would draw attention to one or two points.

The diagram accompanying the article in question shows certain curves of recuperation. The best curve is that of No. 1 well taken in July, 1908; the other curves taken in 1912 show a very considerable falling off in the rate of recuperation as compared with No. 1 well in 1908. Now in 1908 No. 1 was the only well; in 1912 there were six wells.

It may be admitted as stated by Lieut. Wilson that the inflow of fine silt into the wells may partially account for the reduced rate of recuperation, but it is not I think enough to account for it altogether. The presence of five additional wells spaced 150 to 160 ft. apart and within a radius of 400 ft. from the original well, must I think be held partly responsible for the reduced inflow on the whole lot when all are pumped simultaneously.

It will be seen from Lieut. Wilson's diagram that in 1908 the recuperation of No. 1 was about 1 ft. 9 in. from a draught of 5 ft. in one hour; in 1912 when five more wells had been added the corresponding rate of recuperation for No. 1 well was only about 8 in. in one hour from a draught of 4 ft. 8 in. The other two wells whose curves are given by Lieut. Wilson show rates of about 11 in. and 8 in. from 5-ft. draught in one hour. Subsequent experiments this year (1913) give a rate of 10 in. to 12 in. from a 5-ft. draught after five wells have been pumped simultaneously.

A great deal of fine silt has been removed from these wells and it is doubtful whether we can look for any great improvement in this respect. We therefore have to reckon with the fact that the rate of inflow into the six adjacent wells is not much more than one-half of the rate obtained from one of these wells, when it was the only well. A rate of 12 in. being quite insufficient to give the necessary supply, the question is what is the greatest depth to which we can safely pump without disturbing the well bottoms and causing inflow of silt. Experience in the rather fine sand at Risalpur tends to show that the sand will not stand a rate of over 1·6 ft. per hour. This rate is obtained at a draught of about 8 ft., and is equivalent to about 2,000 gallons per hour, that is to say we can pump 10,000 gallons per hour from five

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wells, or say 11,000 gallons on an average, as it is only occasionally that we want one well spare for cleaning.

The next question to be answered is how many hours rest must the wells be allowed daily after being pumped down to 8 ft. to avoid permanent depression of the water level. As stated by Lieut. Wilson, the original scheme proposed pumping for 16 hours, giving only 8 hours' rest.

The necessary period can be easily calculated if the true value of "C" (*vide* Lieut. Wilson's diagram) is known. It will be seen from his diagram that with C=¼, and draught 5 ft. the water is still about 5 in. below normal after 10 hours. With daily pumping it would probably be necessary to allow another two hours for recovery, so that even with a 5-ft. draught 12 hours' pumping is about as much as can reasonably be allowed, assuming that ¼ is a fair value for C.

The true value of C at Risalpur must be rather under ¼, and in practice with draught of 8 ft. it is found that about 16 hours' rest is necessary; this allows the wells to recover to within 3 in. to 4 in. below normal. That is to say that the six wells at Risalpur will only stand about eight hours' pumping at the rate of 11,000 gallons per hour. In point of fact in order to obtain reasonable efficiency from the engines, water is pumped at the rate of 18,000 gallons per hour; when the limit of draught is reached the engines have to be stopped until the water has risen sufficiently. The supply is far below what was originally aimed at, and is inadequate for the needs of the cantonment, and the problem now is how to increase it at reasonable cost.

There are other points in Lieut. Wilson's article which call for remark. He states that in the middle of the cantonment the water was found to contain too much salt to make it suitable for permanent use. It is believed that this conclusion was based on the results of a single new well. Be that as it may subsequent experience has shown that good drinking water could have been got in cantonments. The moral seems to be that a water-bearing area should not be too hastily condemned on the evidence of a single well or boring.

The wells as now sited derived little or no benefit from the Kalapani stream. The site plan shown on page 219 of the April *R.E. Journal* is not to scale, No. 1 well being actually about 500 ft. distant from the normal channel of the Kalapani.

The Kalapani is, however, liable to contamination from various sources before it passes the well sites, and it is questionable whether it would have been sound to site the wells so as to obtain infiltration from, the actual stream. The question of filter beds must have arisen, adding appreciably to the cost of the scheme.

The suction pipes are actually 4 in. and not 5 in. as shown in the diagram. The result is that when pumping at the rate of 18,000 gallons the engine must have at least three wells to draw from, and the water in the two last wells cannot be pumped to the full draught. It would have been better if the 5-in. suction pipes as originally designed had been adhered to. As to the means of improving the supply, tube wells provide the only means of doing this at reasonable cost.

Mr. Ashford, of the Canal Department, after several years' experiments, has produced at Amritsar a tube well which successfully obviates the

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infiltration of sand. A 10-in. well tube of this description has been successfully working at Amritsar during the last two years, during which period its output has averaged over half-a-million gallons a day. An equivalent supply from the ordinary masonry well would have cost at least fifty, perhaps a hundred times as much.

For a water supply like that of Risalpur the surface well of masonry with its heavy initial cost and uncertain results is out of date, and it is now proposed to put down tube wells at Risalpur. The result may be of sufficient interest to form the subject of a future article in the *R.E. Journal.*

G. LUBBOCK, *Major, R.E.,*
Garrison Engineer, Risalpur.

14th May, 1913.

WEST BEYNE BRIDGE.

SIR,

May I point out some small errors which have somehow crept into my paper on the West Beyne Bridge in the *R.E. Journal* for May, 1913? They are:—

(*a*). On page 269 in the 15th line from the bottom, the quantity of water should be 6 gallons per cubic foot of cement, instead of 12.

(*b*). On page 273 in the 13th line from the top, for "renewed" read "removed."

(*c*). On page 279 the prices of sand and stone given—viz. Rs.33/- and Rs.18/- respectively, are per *hundred* cubic feet and not per cubic foot. The same mistake also appears on page 280.

(*d*). The cost of labour for concreting with a gang of 50—60 men worked out to Rs.8.25 per *hundred* cubic feet.

Yours faithfully,
E. P. ANDERSON,
Capt., R.E.

Lahore, 19th May, 1913.

The Editor, *R.E. Journal.*

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BOOKS RECEIVED.

SERVICE CHEMISTRY: Being a Short Manual ot Chemistry and Metallurgy and their Application in the Naval and Military Services. By Vivian B. Lewes, F.I.C., F.C.S., and J. S. S. Brame, F.C.S. Fourth edition. Revised and illustrated. 1913. Price, 15s. Edward Arnold, 41–43, Maddox Street, London, W.

THE FIELD ENGINEER'S HANDBOOK. A Handbook of Field Engineering for Civil Engineers and Engineering Students. By G. Carveth Wells, A.C.G.I., and Arundel S. Clay, B.SC., A.C.G.I. With illustrations and tables. 1913. Price, 7s. 6d. Edward Arnold, 41–43, Maddox Street, London, W.

QUESTIONS DE CRITIQUE MILITAIRE ET D'ACTUALITÉ (5e *série*). Général H. Bonnal. Paris. 1913. Chapelot. 295 pages. Prix, 3 fr. 50.

LES ARMES AUTOMATIQUES. ÉTUDE DU FONCTIONNEMENT MÉCANIQUE. Capitaine Cordier. Paris. 1912. Imhaus et Chapelot. 140 pages. Prix, 2 fr. 50.

L'ÉVOLUTION DE LA MARINE AMÉRICAINE. Capitaine de frégate de Roquefeuil. Paris. 1913. Chapelot. Prix, 2 fr. 50.

LES AÉROPLANES DANS LA GUERRE D'AUJOURD'HUI. Lieutenant de Boisricheux. Paris. 1912. Imhaus et Chapelot. 33 pages. Prix, 0 fr. 5.

OFFICIERS MAL INSTRUITS ET MAL PAYÉS (d'après de récentes publications anglaises). S.R. Paris. 1912. Imhaus et Chapelot. 22 pages. Prix, 0 fr. 60.

LE GUIDE DE L'OFFICIER CHARGÉ DES COMPAS. Capitaine de vaisseau Louis Mottez. Paris. 1913. Chapelot. Prix, 2 fr. 50.

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NIGHT MARCHING.

Lecture by COLONEL F. R. F. BOILEAU, *General Staff, 3rd Division.* *(Given at the S.M.E.).*

THE subject of my lecture is night marching, interpreted in the very broadest sense. I propose to touch on many points from the moment of leaving camp or bivouac until the moment of assault. Forgive me if my lecture is somewhat like a tailor's bill, a mass of disconnected items. I will try to extract the points which may be of use to the majority of officers here, and make no apology for mentioning details.

The closer night enterprises are studied, the more patent it becomes that their success depends on the forethought given to points of detail before initiation. In fact it is the lack of this forethought that has led to more failures than the enemy himself.

Let us endeavour to realize wherein lies the difficulty of conducting a night operation as compared to an operation by day. This may be taken under three headings :—First, the difficulty of supervision or co-operation ; secondly, the exaggerated effect of what by day are minor causes ; and lastly, the difficulty of simulating in peace the tension which prevails in a night operation during war. In fact it is the curtailment of one of our senses which renders these operations so very much more liable to accident than those carried out by day. So, before the very smallest operation by night, we want to foresee everything we possibly can to avoid such accidents. When you have been through the detail, and, before starting to march, have explained to everyone the duties he has to perform, allow no changes from the original plan, as it is obvious that any deviation from that plan, the details of which have been communicated to all concerned, may and probably will lead to disaster.

When the Japanese embarked on their last war, their tactics did not legislate for either night marches or night attacks ; however, it was comparatively easy for them to learn during those difficult circumstances of war, in that they are passionately devoted to detail and have that mutual confidence from highest to lowest which is so especially vital in night operations.

To sum up, do not undertake lightly any night operation, exert all possible care and forethought to avoid fatigue to men and the chance of failure, and lastly, once a plan is adopted and initiated do not deviate from it. Though caution in council is advisable, boldness in execution is essential.

Now we will imagine, each one of us, that we have got to carry

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out a night march. The first thing necessary is reconnaissance. To a lack of a proper reconnaissance most failures may be traced. In 1685, at Sedgemoor, Monk's reconnaissance revealed two ditches over which he got in safety, but there was a third which defeated his object and cost him his head. In 1799, at Seringapatam, Wellesley with his regiment was told off to attack a position and capture it before dawn ; he returned at midnight cursing himself for not having reconnoitred the ground before he marched. He too had run into an unseen nullah.

So that we come to this : a detailed reconnaissance is equally essential in a night advance or a night attack, and in a night march off a road or when the enemy is close up. When the enemy is distant, and good maps, good roads, and good guides are available, some latitude may be allowed, but if time will admit even in these circumstances a reconnaissance should be made.

Too much time cannot be devoted to this reconnaissance. Find out all you possibly can about the roads that you intend to go along, or the intervening ground that has to be crossed, and also about the enemy. One very important thing about the enemy is, that once touch with him has been obtained it must not be relaxed either by day or by night until the operation has been completed.

This reconnaissance must be carried out by two officers, so that if necessary one may be left to observe the enemy and the other go back to report to the G.O.C. Or one may get damaged and the other can still carry on with the work.

R.E. officers should always be prepared to carry out this duty, but before you can hope to be entrusted with this responsible task I would urge on you to prove your capability for it during peace training. There is a tendency among officers of other arms to think you are too hard-worked to undertake it. My advice to young officers is, push yourselves into every night operation you can get a chance to attend—a welcome will always await you.

When doing a reconnaissance, if along a road, observe physical features but do not observe too many ; compass bearings are hardly necessary here.

Suppose we cannot cover the ground and our reconnaissance has to be carried out from a distance, how then ? Go up to any piece of high ground where you can get the best view of the country to be reconnoitred, scan every inch of it with your glasses and watch movements of the enemy, inhabitants, cattle, or anything else that may indicate incidents of ground.

To make a very rough panorama of the ground to be covered is of the greatest assistance to reveal the incidents of the ground and the point which has to be reached. This will enforce the study of the ground and fix it in the mind. All bearings should be very carefully checked.

Field Service Regulations very rightly lay down that information as to the distance to be covered must be obtained, and, in order

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that you may not be caught in a state of unpreparedness, use every possible means to get this distance. If you have got a good scale map measure it off on that. A range finder may not always be handy.

As a last resource, triangulation with the service pattern compass carried by all officers gives results which are quite useful. (See *Fig.* A). An additional advantage is that bearings which cannot actually be measured on the ground can by this triangulation be obtained by a rough plotting, which should be done at a scale of 3 to 6 in. to the mile on any piece of paper.

A good plan, if you can cross the ground, is to put out marks that may assist you to pick out points, such as pieces of paper, etc. Care must be taken that such marks afford no indication to the enemy, that they are distinct in darkness, and that they are not liable to be blown away. During the retreat on Corunna poles were put up with bundles of straw on the top; these were blown away, with the result that 2,000 men were lost.

Lastly, I would urge you not to neglect reconnaissance even if good guides are available. You have got to remember that the pace is slow, the responsibilities are very great, and the conditions are so strange to a local guide that he is apt to lose his sense of direction. You should invariably have some check on him.

One word about plotting the reconnaissance; this should invariably be done, even if it only consists of one bearing and one distance. There is always a chance that an officer may get damaged, and another have to carry on. There should be some uniformity of plotting. This was advocated some years ago but has now been omitted. (See *Diagram No.* 2).

Figures $\frac{3}{4}$ inch by $\frac{1}{4}$ inch broad in black ink on white paper can easily be read on the very darkest night. If plotted on luminous cardboard the figures can be made smaller.

Do not have too many figures and do not try to remember too many points, otherwise confusion will result.

Let us be clear how we are going to guide a column. If it happens to be along a road, have marked on your reconnaissance one or two culverts, trees, houses, or anything that may indicate to you a point you have met with before. Great difficulty comes in if you are marching across country with nothing to guide you. In that case you are bound to rely on the compass.

The Japanese on one occasion only used a compass, as far as I can find out. Most of their night marches took place in a country prolific in physical features and they marched from one to another. These may not always be available, and you may sometimes have to march for a distance on a compass bearing.

To alter the bearing set on a compass demands a light. Each officer guiding the column should have an "ever ready" electric torch or bull's-eye lantern, but lights of any sort are always to be deprecated. But we must have some means of altering our bearing,

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and for this two or three compasses should be carried, each set to a particular bearing and labelled very distinctly.

Another method is to fix the compass in a piece of cardboard perforated to grip the instrument. On the cardboard the various bearings required are marked off in thick black lines from the outer edge of the compass. (See *Diagram No.* 1). It will be observed that the line with the arrow-head is always the direction of the march.

In all cases the compass should be tied to your person. On two occasions it has been my luck to see the owner of a compass parted from it—in one case the officer went down a blind well and in the other it was dropped on a rock and broken.

When the north star is visible, a quick method is to "span the heavens," *i.e.*, go round the horizon starting from below the north star with a span of the hand, which equals 18 to 20 degrees, *vide Field Artillery Training, Fig.* 21.

I know of a case of a well-known officer who had to march to a point over ground strange to him to find a flag planted by two other officers during the daytime. Arrived at the place of departure he found his compass broken. He was not a bit nonplussed although he had to march on three or four bearings. He went in for "spanning the heavens," the north star being visible, marched the 3 miles and fetched up within 50 yards of the point selected.

The text book tells us that the stars may be of use to us, but most books on the subject are so deep, or so long, or so complicated that we cannot apply them to tactical purposes. The only way to use the stars tactically is to make friends of them by getting to know the names and habits of a few of them.

Tel-el-Kebir is always quoted as a magnificent example of how a column can be led by the stars. I am quite sure that the gallant naval officer who led that column did not undertake any complicated calculations, but observed for a night or two and saw several stars he knew which came up in the correct alignment at required intervals. I firmly believe that that is the only practical use of stars for our tactical purposes.*

Amongst other methods of guiding a column, one is by means of two lights aligned. The Japanese used that method on two or three occasions. See that one light does not obliterate the other. If possible have one above the other. There is always the chance of these lights giving away your intention to the enemy.

On a very dark night when there are no pronounced features to assist, and the compass, only, has to be relied on, a light should be put up to act as a reference point which should be visible to the officer guiding and not to the enemy.

Another system often advocated is that of aligning men one in front of another, but to do this while at the head of a column is too

* For making friends of the stars I strongly recommend *The Star Pocket Book*, by R. Weatherhead, R.N., price 1s. 6d.

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slow. The aligning of men is not easily done. There is only one method, and that is to take advantage of the twilight and push forward with 30 or 40 men, dropping them at suitable intervals in pairs. When the column comes to one pair, one of the men leads it to the next pair, and so on. One man should not leave his post until the column has gone by. A small rear guard from the unit to which they belong should collect these men.

In dense forests and along narrow tracks where men could not be put out beforehand, some 20 to 30 men should be pushed on from the head of the column with the guiding officer. Files are dropped along the track at easy communicating distance from one another. Thus some 1½ miles can be covered. Word is then passed back for the column to advance. By this method the continual halting and starting is avoided. When the guiding officer is reached the procedure may be continued.

A word of advice to the guiding officer : in case of doubt, above all things keep your head. Examine carefully the lie of the land and do not show what is passing in your mind, as uncertainty will soon communicate itself to those behind you. Halt the column and carry out any necessary reconnaissance, leaving your assistant at the guiding point. If absolutely lost much better own up and do not risk disaster.

To the officer in command : do not worry the man at the wheel—unless you can trust him he should not have been put there.

The diagram issued shows a night march diagrammatically as a basis for the consideration of certain points which have to be seen to from the moment of leaving bivouac to the moment of assault. From bivouac or billets to the outpost line is some 3 miles or so, and scouts have been pushed on to piquet the enemy. If the column is composed of two or three units, they should be assembled before starting, an officer from each unit meeting the commander at the starting point.

The formation along the road would of course be in column of route until reaching the outpost line. Here we leave the road, so that we drop our normal marching formation at this point, which usually would be called the position of assembly, and adopt a suitable formation so that we can deploy easily should we come on the enemy before he is expected. Marching is continued across the intervening ground until we reach the position of deployment. The formation on the diagram is for the purpose of an attack by night and not for a dawn attack.

There must be absolute silence until the moment of assault, when to my mind it becomes a very moot point as to whether you should go in in silence with the bayonet, or whether you should go in with cheers. Silence would seem on the whole to be best.

The guiding officer has to set the pace ; let that be as slow as you can. The longer the column or the rougher the ground the slower

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the pace. 2½ miles along a road and 1½ miles per hour across country would be good. If the pace is too fast connection will be lost, which not infrequently happens when the pace is quite steady. So it is necessary that the column should occasionally be patrolled from beginning to end to see that march discipline is strictly enforced and connection is maintained. It has a reassuring effect on the men to see an officer from the front come down the line, especially in the case of a long column.

Connection between units must always be maintained by means of files of men, so that one can go forward with a message while the other remains at his post. Usually we hear that 10 paces should be the distance between these files, but the governing factor should be the condition of the ground and the intensity of the darkness.

We have also tried keeping up connection by means of ropes such as are used for a skeleton enemy. The use of ropes presupposes open country.

Another method tried in India was the use of a candle in a tin with perforations in the sides and rear. This worked most excellently, but the use of any sort of light is to be deprecated.

Before starting on the march one officer from every unit would report to the officer commanding the column to carry messages to his unit. Each unit commander, also, should have with him two or three orderlies who have been trained to deliver messages slowly, accurately, and in a low voice.

Now imagine we are marching across the intervening country and we have to deploy, a matter of some difficulty. Nowadays we are better at it as troops are more highly trained.

Deployment has to be carried out before leaving the position of deployment, and the formation should have been clearly explained to all officers before starting. If deployment has to be carried out on a new alignment, this would be assisted by putting out marks or markers.

Two examples may be given to bring out points which have been mentioned. The first is that of Lombard's Kop, the day before Ladysmith was sealed. The scheme was a bold one. The enemy was believed to be on Long Hill, and one brigade with artillery was to advance up to a position to the south of Long Hill. Another brigade was to march out early in the morning and take up a position on Limit Hill with a view to an attack on Pepworth Hill. A third column was to push forward and seize Nicholson's Nek to protect the left flank of the attack on Pepworth Hill and Long Hill. The cavalry were to push out at daybreak and come up on the right flank.

The first column should have started at 10 p.m., but did not rendezvous until 11 p.m., due to restive pack mules. It got off eventually, but the progress was slower than anticipated.

As the column to attack Long Hill marched off some artillery

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turned up with orders to sandwich in between the second and third battalions. This artillery also had orders to leave the column at a certain place and take up a position at Limit Hill, which fact was not communicated to the battalions and artillery in rear, with the inevitable consequence that the rear of the Long Hill column and all the artillery moved off to Limit Hill. Moral—See that a column is patrolled.

The enemy was not at Long Hill at all, but was away on the right flank. At daybreak a change of front had to take place. Moral—Piquet your enemy and see that he does not change his position.

The next example is the Battle of Adowa in 1896.

The Italian Commander (Barateri) proposed to move at night to a position of readiness from Mount Esciascio to Mount Belah in three columns. The right and the left composed of one brigade each, and the centre of two brigades. (Routes of the brigades shown on the map). The country is rugged and the hillsides covered with scrub. The movement of the troops was confined to the paths shown, along which they could move in file. Movements off the road were not possible in the dark. Each column was to be led by a local guide. In the same year the Italians had been all over the country, but it had not been reconnoitred with a view to a night march. The right and centre columns were directed to the vicinity of Col de Rebbi Arienne, and the left column to Col Chidane Maret by route south of Addi Cheras.

There was a moon with clouds occasionally passing over it. At 9.30 p.m. the three columns started, and at 11 p.m. for some unknown reason the column on the left cut in between units and the centre column, the bulk of which had to halt until the left column was clear.

Question 1—What should be the action of O.C., centre column? Answer—Immediately report to Barateri.

About midnight Barateri rode up and saw a long line of sleeping men of the centre column. He made enquiries and was told that the column on the left had crossed their path.

Question 2—What should he have done? Answer—Seriously have considered the abandonment of the project, and if much delay caused, to have tried another night instead.

The left column moved to Col Chidane Maret, where it proposed to halt in accordance with instructions; but the guide insisted that the place intended was Enda Chidane Maret, 4 or 5 miles further on.

Patrols sent out to the right to gain touch with the centre column returned about 3 a.m. and reported no sign of it.

Question 3—What should be the action of the O.C. left column? Answer—Not move on until communication was established with Barateri or right column.

The left column pushed on as advised by the guide, the other two columns halted as intended.

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The result was that the Abyssinians completely defeated the unsupported left column after daybreak, and later the other two columns. The total result was appalling—261 officers and 5,900 men killed, 31 officers and 1,400 men wounded.

It was Blucher who said, " I fear a night march more than I fear the enemy." Very likely in his day that held good, but I do not think in these days with our higher state of training in these operations the risk is so great if we take the precautions I have mentioned. If frequently undertaken in war, however, troops will lose efficiency through want of sleep, so that night marches should not be lightly embarked on.

Whenever you get an opportunity to make these marches during peace, make them as difficult as possible. Try them over unknown ground on dark nights with only those instruments that would be available on service. All special instruments should be regarded as an additional precaution should they happen to be available when wanted. Accustom yourselves to the ordinary compass.

To my mind training in these matters divides itself into three parts. First, the individual training of officers in the leading of these night operations, and during which each officer picks up his personal error. You learn that you pace 8 per cent. shorter by night than by day, and that you generally step shorter with one leg than with the other. You learn what physical features you can recognize at night. Secondly, there is the individual training of the men. Most of our men are town bred and have hardly ever been in real darkness.

A system I recommend is what is called in India " dog-and-stick " parades. Men are sent out in twos and threes with instructions to report to their company commander at a certain place after dark, having two or three days previously been indicated the position by day when returning we will say from a route march. The men will get a good walk in the evenings and learn to look after themselves.

The last thing is the collective training. That is for the training of the higher commanders in the management of these operations.

In conclusion, one word of warning, and that is, do not be deceived by the amount of training that we do in night marches into thinking that they are to be used frequently. Remember that they must be used with the very greatest caution. A night operation is a very delicate weapon which if not used with great judgment will rebound and wound the user.

Finally you ask me how long scouts should remain out to the front or whether they should go right into the attack. I can only add that it is found in practice that after a few hundred yards have been covered the scouts have generally melted away, that is, they have fallen back into the troops ; as these latter are deployed, or in other words cleared for action, the surprise of striking the enemy should not seriously affect them.

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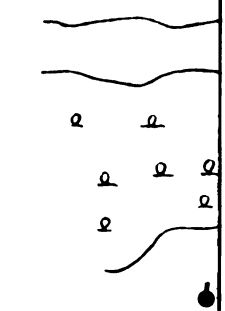

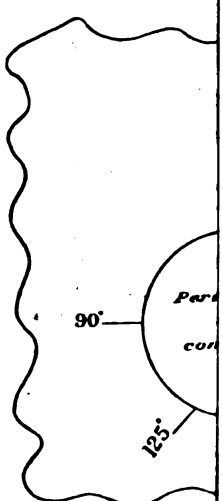

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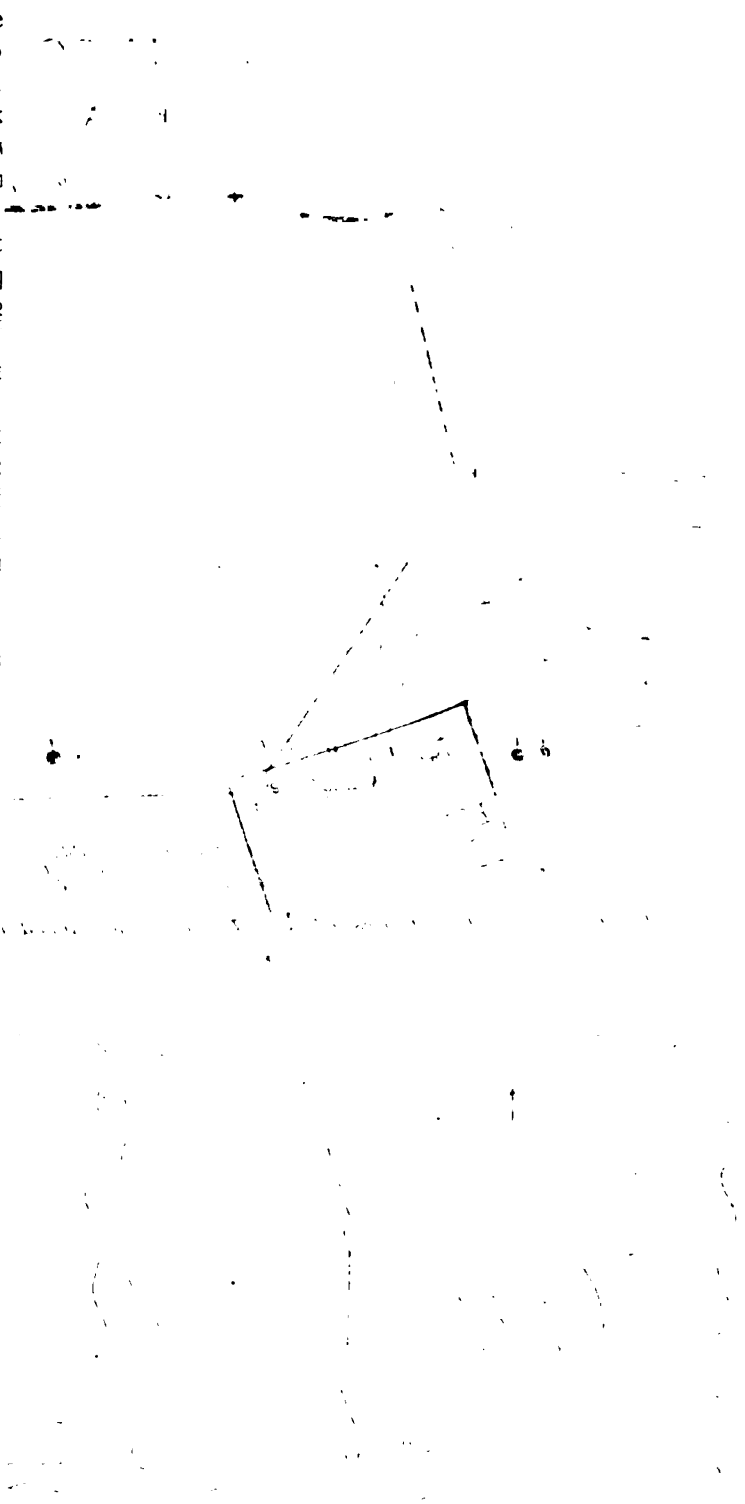

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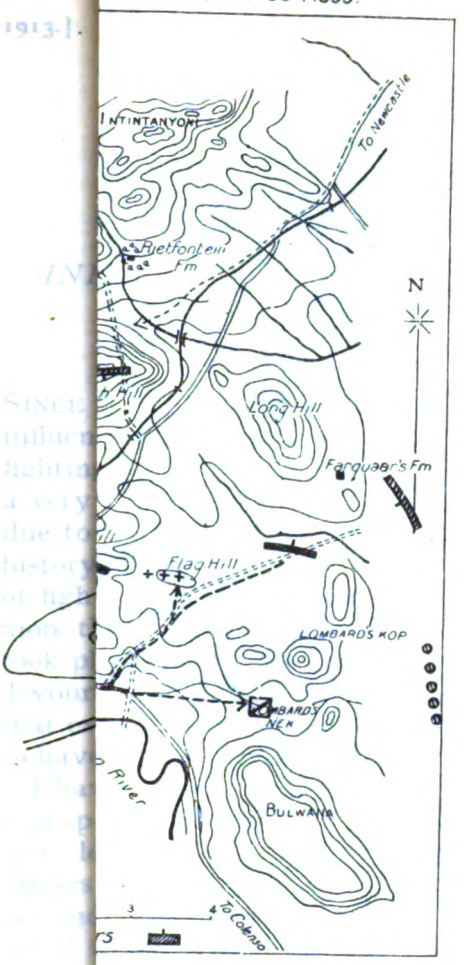

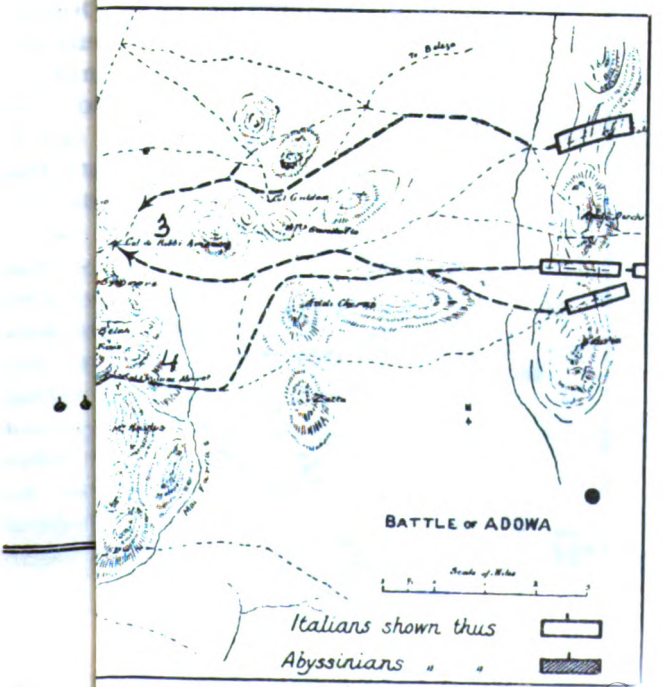

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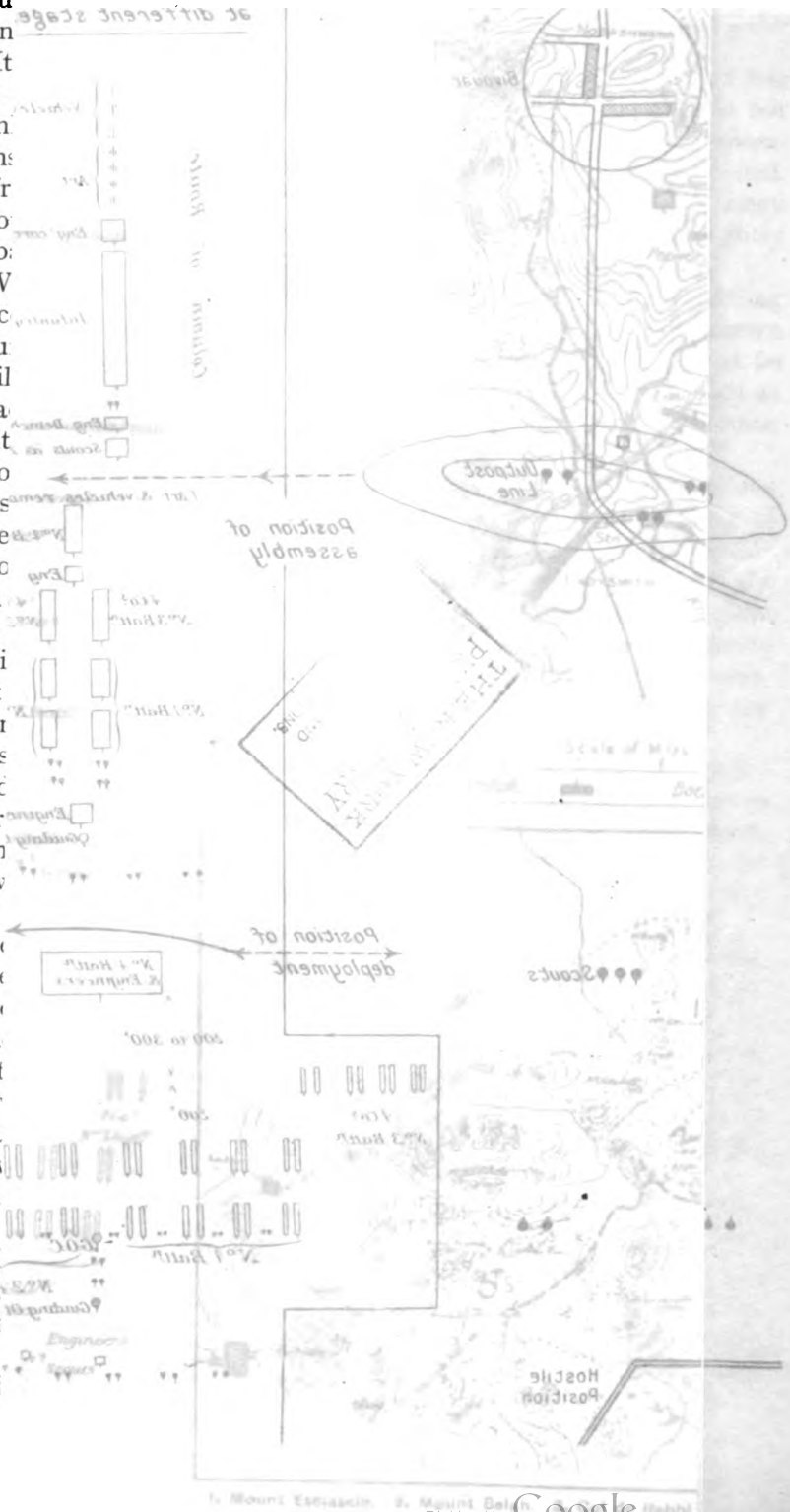

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INFLUENCE OF WOODS ON MODERN WARFARE.

By CAPT. W. G. S. DOBBIE, R.E.

SINCE the very earliest times woods have exerted a very considerable influence on war, both in the region of strategy and tactics. Wood fighting, that is to say fighting in the interior of woods, has only in a very slight degree been affected by the improvements in weapons due to the discoveries of science. This being so we can learn from history more of the tactics of wood fighting than of any other kind of fighting we may have to undertake nowadays. To go back no more than 3,000 years we read of one of King David's battles which took place in the wood of Ephraim, and we are told that " the wood devoured more people that day than the sword devoured." So that even in those far-off days the influence of woods on war seems to have been appreciated.

I have said that woods influence both tactics and strategy, and so I propose discussing these two points separately. Taking tactics first, let us approach the question broadly to start with. Many officers are of the opinion that woods are only shell traps and should be studiously avoided by all prudent soldiers. One has frequently heard this opinion expressed on manœuvres, staff rides, etc., and I cannot help thinking that this opinion is the result of jumping to conclusions rather than the outcome of careful consideration. The teaching of history is altogether opposed to this view. Woods, far from being death traps, have frequently proved to be the salvation of the troops fighting in them, and have enabled these troops to perform deeds which would otherwise have been impossible. A very striking example of this is the fight of the Prussian 7th Division in the wood of Maslowed at the Battle of Sadowa, to which I will have occasion to refer later. In this wood the 7th Division was engaged with two Austrian corps for many hours. Colonel Malcolm in his book on this Campaign says :—" By 11 a.m. 40 battalions and 128 guns were attacking 14 battalions and 25 guns. Nothing but the shelter of the wood, the breech-loading rifle and their own individual bravery saved the Prussians." And yet we are told that woods under modern conditions are only shell traps. In this case the wood not only saved the Prussians from disaster, but also had a most decided influence upon the result of the battle, by attracting from their proper positions two Austrian corps which should have faced north,

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and which should have been able to oppose the advance of the Crown Prince.

There are numerous other examples that might be quoted, but the one I have mentioned will suffice to show that woods need not be the *bête noir* to the modern soldier that some would make them out to be. Their characteristics are very similar to those of villages, and most of the arguments about villages apply in a greater or less degree to woods. As a matter of fact, whatever our views on this subject may be, we will have to fight in woods whether we like it or not. In most countries there are a large number of woods, and we shall not be able to do in war what we do on manœuvres, and put an inconvenient wood out of bounds, or call it an impassable morass. Jackson virtually did this at Fredericksburg, leaving unguarded a portion of a wood which he thought was impassable. The Federals of course chose this point for their advance, and caused him some very anxious moments. I think that we can less afford to ignore woods than villages, as the former cover a greater extent of country than the latter, and so cannot be avoided. We may frequently exercise our choice as to whether we will fight in villages or not, but usually we will not have any choice in the matter of woods. In these days of aeroplanes woods have greater importance than ever before. All this being so, I think it behoves us to study the subject and try and find out how we can best turn woods to our advantage.

Artillery Fire.—The chief reason given for avoiding woods is the supposed effect of modern artillery fire, and this was, I believe, the reason advanced by General Bernhardi. Let us therefore examine as far as possible the effect that guns will probably have on troops in woods. In doing this we should differentiate between the cases of troops holding the edge of a wood and those in the interior, as the conditions are totally different.

Effect against Edge of Wood.—Against troops holding the edge of a wood the conditions are not very different to those prevailing in any other part of the battlefield. If the edge is well defined the target for the hostile guns will be good, and their effect should be great. Both shrapnel and high-explosive shell could be used with effect. Shells that just pass overhead, which in ordinary positions would burst some distance beyond, will be caught by the trees at the edge of the wood and be exploded just above the defending troops. The effect of these may not actually be very great (in the case of shrapnel the effect will probably be ***nil***), but the effect on the nerves will be considerable, as, owing to the greater number of shells exploding near them, the troops will think they are under a much heavier artillery fire than is really the case. Of course the troops can leave the front edge unoccupied until the last minute, but in this case the attacking infantry will be able to approach to

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short range without loss. If the defenders can be supported by their own artillery, the circumstances will be much the same as in any other part of the field—but if they are not supported by artillery, they will not usually be able to hold the edge for long. A good example of this occurred in the Battle of Worth, where the Germans were enabled to bring heavy artillery fire against the edge of the Niederwald, and, as the French did not support their troops with artillery fire, the former had no difficulty in gaining the edge of the wood.

Against Interior of Wood.—Against the interior of a wood, artillery fire must be more or less at random. It will be impossible for the gunners to know exactly where the enemy is, and aeroplanes can give no assistance here. In the case of a small copse things are of course different, as the occupants have no room for changing their position, but in the case of a large wood a very small proportion of shells will find a billet, and so, in order to achieve a certain result, an enormous expenditure of ammunition will be necessary.

Time Shrapnel.—Time shrapnel is generally considered ineffective, though this view is not universally held. Colonel Bethel in his book *Modern Artillery in the Field* on page 367 says :—" The effect of shrapnel fire upon troops among trees is very good, as the bullets seem to glance in all directions." The general opinion, however, is that the trees will stop a great number of shrapnel bullets, and will partially stop a great many more, so that they will be spent before they hit the man. Although most trees are not sufficiently thick to stop a rifle bullet, they are quite a match for shrapnel bullets. The presumably official view as expressed in *Military Engineering*, Part I., § 285, is that " Troops will to some extent suffer from splinters of wood and falling branches, but these mostly give slight wounds. A certain number of shrapnel bullets will be stopped by tree trunks and branches."

Percussion Shrapnel.—Perhaps percussion shrapnel might be employed, but I do not think that this would help matters very much, as the shrapnel fuze is so sensitive that the shell will be exploded on contact with the topmost twigs, and it will therefore have no advantage over time shrapnel. Percussion shrapnel fitted with a delay action fuze would no doubt be better, but even so it would not be as effective as high-explosive shell.

Plunging Fire Essential.—But whatever kind of shell is employed, it is obvious that a steep angle of descent is imperative, as it is necessary for the shell to get to the ground level more or less before it bursts. This plunging fire can only be obtained in three ways :—

(*a*). By the use of howitzers.
(*b*). By guns firing at extreme range.
(*c*). By guns placed on commanding positions.

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The use of howitzers is the best way of gaining the desired result. Even at very long ranges the angle of descent of an 18-pr. shell is only one in three, and as even this will not be sufficiently steep, field guns may be considered as unsuitable for fire against the interior of woods.

Nor are convenient commanding positions likely to be found. To get an appreciably improved angle of descent in these days of high velocity and long range guns, a position would have to be found on the top of a fairly high mountain. There is of course the classic instance of the fire of the Austrian guns against the Maslowed Wood. The guns were perched up on some fairly high ground overlooking the wood. But it was only their low velocity that enabled them to bring plunging fire on to the wood. Put a modern 18-pr. in the same position and its shells will skim the top of the trees and not penetrate into the wood.

High-Explosive Shell.—As regards high-explosive shell, and their effect in a wood, we have no reliable data on which to base our theories. Opinions of artillery officers vary very considerably. Some think that a few high-explosive shells will have an extraordinary effect and quickly clear a wood of its defenders. Others are not quite so sanguine. To quote again from the text book of *Military Engineering*, Part I., para. 285, we are told:—"As for high-explosive shell, their effect will presumably be no worse in a wood than out of it, though here and there a tree may be brought down. A large number of splinters will be stopped, and the concussion will be somewhat modified." It certainly seems to me that the trees will localize the effect of the shell burst, and will form ready-made splinter proofs, though of course the effect of the detonation in the actual area in which the shell falls will be very complete. *Field Artillery Training*, para. 109, draws attention to the fact that only a very local effect is caused by the explosion of high-explosive shell. Personally, I think that I would rather have a high-explosive shell fall 25 yards from me in a wood than at a similar distance in the open.

It therefore seems that the only shells likely to produce any appreciable effect against troops in woods are the high-explosive shells fired by howitzers.

As I have already pointed out, in order to produce a given effect, a tremendous amount of ammunition will have to be expended and will it be considered advisable therefore to use up possibly all the high-explosive shell against a target, when the effect cannot be seen or found out in any way?

If the whole brigade of howitzers is detailed to shell the interior of a wood, the guns will either fire rapidly and so use up all their high-explosive shell very quickly, or they will fire slowly, and only do what one battery firing quickly could do. If one battery were detailed alone, it would soon use up its high-explosive shell, or it

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would have to borrow from the other two batteries of the brigade, a course which seems to be teeming with objections and practical difficulties. As in the case of villages, ammunition supply will be the deciding factor.

Moral Effect.—The effect then of artillery fire against troops in woods will not be nearly as great as is generally supposed. But the effect on the nerves will be very considerable, and it is this which tells in the long run. It seems to me that peace training can do much to help in this matter by making the troops appreciate rightly the limitations of artillery fire. The attitude of a great part of the British Army in this connection is due to a misconception, and if troops are taught that woods positively limit the effect of shell fire, their *morale* will start at a higher level when they find themselves subjected to this fire.

Historical Examples. (*a*). *Maslowed.*—Before leaving this question of artillery fire I would like to refer briefly to two historical instances. The first is one to which reference has already been made —viz. the fight at the wood of Maslowed.

In this case 100 Austrian guns were playing on this wood, which is considerably less than a square mile in area. The guns were on high ground and were able to fire down into this wood with a plunging fire. Marks had been previously fastened to the tops of the trees to assist the aim of the gunners, and there were a very considerable number of Prussian troops in the wood at the time of the bombardment. Further, the Austrian gunners were hardly molested at all by the Prussian artillery, and so were able to devote all their energies to the task of exterminating the Prussian infantry in the wood. The whole of the circumstances were entirely favourable to the Austrian gunners, and yet the result was not very striking. During the whole day's fighting the 7th Division lost 2,000 out of 14,000 men or 14·3 per cent. The greater part of these losses was incurred in the fighting with the Austrian infantry, and the amount due to the artillery fire in the interior of the wood must have been very small. The total loss of 14 per cent. cannot be considered excessive when one remembers that this fight is usually considered as one of the most desperate on record.

Wood of Sadowa.—Another similar fight was being carried on in the adjoining wood of Sadowa, the 8th Division being subjected to very heavy artillery fire. The range was very short (under 1,000 yards in some places) and the Austrians knew exactly where the Prussians were; and yet Hozier says in his book on *The Seven Weeks' War*, "the guns did not inflict as much loss as would be expected."

Bois de la Garenne.—Towards the close of the Battle of Sedan a considerable body of French troops was occupying the Bois de la Garenne. This wood was to be attacked by the Prussian Guard

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Corps, and the whole of the artillery of the Guard Corps commenced shelling the wood so as to pave the way for the infantry advance. The right-hand gun of each battery fired at the edge of the wood, the next gun 50 yards in, and so on, so that a very considerable area was covered with shell fire. The French were very much shaken by this fire, and when the Prussian infantry advanced, they surrendered without any further opposition. The large number of unwounded prisoners, however, bore witness to the comparative harmlessness of the artillery fire, though the moral effect was very pronounced.

Three Phases.—Wood fighting seems to be divisible into three distinct phases. The first is the fight for the edge of the wood, the second is the struggle in the interior, and the third is the debouching on the enemy's side of the wood. The conditions in each of these three phases are totally dissimilar. In the first the attacker is apt to have artillery predominance. In the second, the guns on both sides can do little or nothing, while in the third the defender will probably have superiority in artillery fire. This being so, the advantage will at first rest with the attack, but the pendulum will gradually swing over, until the defenders are in the better position. Of course a statement like this can only be very general, but it is the sort of thing that has happened many times in the past, and will presumably happen again. The general inference is that a wood will not be a suitable point for the decisive attack.

Front Edge.—To discuss these three phases in turn. The fight for the front edge should be considered first. The attackers here will have the advantage unless the defenders can gain superiority of artillery fire. If the defenders cannot support their troops with gun fire, the front edge will probably become untenable. One sometimes sees it advocated that the front edge should not be held, but that a position some 200 yards or so in front, with the idea of escaping the effect of the hostile artillery fire, should be taken up. In the text book on *Military Engineering*, § 278, we are told that "where the line of defence of necessity follows the general direction of a wood, the firing trenches should if possible be thrown out 50 to 150 yards towards the enemy, for the sharply defined edge of a wood is easy for artillery to range on, and the noise of bullets and shell crashing through the branches overhead has a most unsteadying effect." Some may consider that this plan presents difficulties, for in the first place the trenches will be completely isolated, unless communication trenches to the wood are dug, and these may possibly prove to be conspicuous and give away the position of the fire trenches. The attacking infantry, also, may sooner or later discover the position of these trenches and pass the word to the supporting artillery, and one of the chief advantages of woods is that the supports can move about under cover and reinforce the firing line wherever necessary. If the firing trenches are put 150 yards in

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front of the edge of the wood, this advantage is given up. This question is really exactly the same as the question "should fire trenches be placed at the bottom or the top of a hill?"

If it is considered likely that the enemy will have overwhelming artillery superiority, and if it is still desired for any reason to hold the front edge, I think that the best plan will usually be to hold the front very lightly, and concentrate the defenders at some point within the wood, and, as soon as the attackers gain the edge of the wood, counter-attack with the bayonet. This plan was adopted by the French at Worth, and only failed in some instances because the counter-attacks were carried too far. When the advanced guard of the 11th Corps approached the Niederwald, the edge was only held by two companies of the 3rd Zouaves, who retired in front of the 10 Prussian companies. As these attempted to penetrate into the wood they were counter-attacked by the Zouave Battalion and driven out of the wood and across the Sauer. Thus although the edge of the wood was under heavy artillery fire, four French companies repulsed the attack of 10 Prussian companies. In this case the pursuit was not carried beyond the edge of the wood—and the operation from the French point of view was entirely successful. Colonel Henderson considers this an ideal counter-attack.

If on the other hand it is considered advisable to hold the front edge in strength and to dispute the advance of the hostile infantry, it will, I think, be best to hold a line a few yards clear of the wood. This has not got the objections of the line 150 yards in front, but has many advantages. The actual edge of the wood is generally very difficult to entrench owing to the roots and the trees. If the line is chosen just clear of the roots, a trench can be dug as easily as anywhere else, and the advantages derived from a wood are not given up.

The Bayonet.—The fight inside the wood is very primitive in character, and it is the kind of fighting on which improvements in firearms have had little or no effect. Troops armed with spears would not be at a very great disadvantage against troops armed with the magazine rifle. The corollary is, of course, that the bayonet is the most suitable weapon for this kind of fighting. Fire action will be used to some extent, but most of the work will be done by the bayonet. The Americans did not hold this view in 1864. In the fighting in the Wilderness the bayonet was but little used, and nearly all the casualties were caused by rifle fire. In 1866 and 1870 the very opposite was the case, and I think that this latter is the true teaching of history. Many of the American soldiers were accustomed to the use of firearms in peace time, and I think that they naturally were more inclined to shoot than to use the bayonet, which is essentially the weapon of the Regular soldier. Colonel Henderson says:—"Troops that will use the cold steel in woods have the best chance of success." General du Cane says:—"The value of the long range

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of modern weapons must be considerably reduced in wood fighting, and that of the bayonet correspondingly enhanced.

Effect of Counter-Attack.—Perhaps the most striking lesson we learn from the study of accounts of wood fighting is the extraordinary effect of counter-attacks. Even very small bodies of men, led boldly to the attack, have driven far greater numbers of the enemy in disorder from the wood. This is of course due to the confusion that is bound to arise among the attacking troops during their advance through the woods, even though the resistance be slight. In the fight in the Niederwald at the Battle of Worth the French repeatedly drove the Germans back out of the wood. The French charged with the bayonet, and the sight of the compact mass of men sweeping down on them was too much for the disordered Germans.

There seems to be no limit to the effect of these counter-attacks, so long as they are carried out judiciously. It is said that "the best is enemy to the good," and the French certainly made the mistake of carrying their counter-attacks too far. To stop a victorious charge of this kind is not easy—but it must be done, and it requires good troops and good peace training to accomplish this result. Troops that are lacking in discipline are bound to fail in this, and will be at the mercy of a far smaller number of good troops so far as wood fighting is concerned.

The same principles apply to the attacking side, that is the side that is attempting to advance through the wood. At all hazards must the men be kept together. Compact bodies of even a company or less will have a very great influence in restoring the battle and gaining ground to the front. The success gained by the 26th Prussian Regiment at the Maslowed Wood was due almost entirely to the compact formation in which its battalions traversed the wood. It is interesting and instructive to notice the way this same regiment failed four years later in wood fighting through disregard of this principle. General Clery in his *Minor Tactics* on p. 311 says:—"Should they (the supports) become eventually engaged, great efforts should be made to collect small bodies to act as fresh supports. Groups of this kind under control may be made to intervene with great effect either to parry a local flank attack or to effect one, or to serve as temporary rallying points. It has been asserted that the success of the Prussians in maintaining themselves in the Swiepwald at Sadowa against nearly four times their numbers was greatly due to the use made of small bodies of this kind.

Clearings.—Clearings will be frequently met with, and they will be extremely difficult to cross. The 2nd Bavarian Corps was hung up nearly the whole day by a clearing at Worth. It would seem that they made rather more of the difficulty than necessary, as their losses during the whole day were only 700 men. The 11th Corps also found considerable difficulty in crossing the clearing between

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the Niederwald and the Elsasshausen Copse. It was only through an ill-judged counter-attack of the French which was carried too far, that the Germans succeeded in crossing the clearing along with the discomfited French.

There seems to be no reason why guns should not be run up by hand to assist the troops at a clearing. This was done on several occasions in the Wilderness in 1864, and if it could be done then it will be easier to do now owing to the shields with which guns are provided. Of course if it is possible to edge round the clearing both sides will attempt to do so, and the clearing will become a sort of No Man's Land. Clearings undoubtedly strengthen the defence.

Tenacity of Troops in Woods.—Troops that are well trained in wood fighting will be very difficult to drive out of a wood, even if they are but few in number. The advanced guard of the 11th Corps hung on to the eastern piece of the Niederwald, that projects towards Spachbach, after the rest of the corps had been forced across the river. This of course greatly assisted the further operations of the 11th and 5th Corps. The way in which the 7th Division resisted the attacks of the Austrians at Maslowed, although outnumbered by four to one, has already been referred to, and is a striking example of the tenacity with which woods can be held.

Penetration of Bullet.—I have pointed out how little this kind of fighting has been affected by the improvements in firearms. Since 1864 and 1870 there has, however, been one important change, and that is the greater penetrative power of the small-bore bullet. Trees which in 1870 would easily have stopped a bullet, will now no longer be able to do so; in fact a tree that is bullet proof will be a very rare exception, as 3 ft. 6 in. in the case of hard-wood trees and 5 ft. in the case of soft-wood trees is the minimum thickness required. Troops should be made to realize this in peace time, as otherwise they may have a rude awakening in war. There is, I am told, nothing more disconcerting than to be struck by a bullet which passes through cover which one has fondly believed to be bullet proof. Often and often one has seen troops sheltering behind fir trees 1 ft. 6 in. thick, while exposed to heavy fire at close range, and feeling so very well satisfied with the excellent cover that nature has provided for them.

Whether this increased penetrative power of the bullet will have much effect on wood fighting, I cannot say, but I do not think it will. Possibly the proportion of casualties from rifle fire will be slightly increased. The tendency will be, I think, all in the direction of increasing the amount of work with the bayonet.

Importance of Knowing the Way about the Wood.—I have pointed out the advantage the defence will have in the use of the counter-attack after the attackers have penetrated into the wood. This will of course be partly due to the fact that presumably the defenders know the geography of the wood better than the attackers. It is very

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easy to lose one's direction in a wood. The Federals frequently did this in the Battle of the Wilderness, and the local knowledge of the Confederates stood them in very good stead. It will generally pay the defender to get to know the way about his wood, better than the construction of elaborate fortifications would pay him.

Position Behind a Wood.—To turn now to the fight at the edge of the wood nearest to the defenders. Here the defence will generally have the advantage. In fact, if a purely passive defence is required in this part of the field, a position commanding the rear edge of the wood will usually be overwhelmingly stronger than any other position. In the first place the wood will be between the defenders and the hostile artillery, and so will shield them very often from gun fire. Then the defenders should be able to bring artillery fire to bear against the edge of the wood, and so make it very difficult for the attackers to debouch from it. Thirdly the attackers will have had all the disadvantages of working their way through the wood, with all the attendant disorder and confusion. The lessons of history are unanimous in pointing out how difficult, if not impossible, it is for troops to debouch from a wood if the defenders are unshaken and are in a position covering the rear edge. The Prussian 8th Division found it impossible to debouch from the wood of Sadowa while the Austrians were holding the open ground beyond. A few Prussian companies at the action of Nachod, held a position covering the open ground in rear of the Wenzelsberg Wood, and completely defeated the efforts of two Austrian brigades to advance from the wood. There are instances also at the Battles of Spicheren and Worth. Bonnal says:—"History has not yet recorded a single great attack that has debouched from a forest or an extensive wood." Of course if one intends taking the offensive, a position behind a wood will be bad, as there is then no point in putting a difficult piece of ground like a wood between oneself and the enemy.

Entangling Edge, and Mines.—If one holds such a position, and if time permits, much can be done to make the task of the enemy of getting out of the wood more difficult. It is a good thing to cut the edge into **V**-shaped pieces, and entangle the re-entrant angles. The enemy advancing will naturally avoid coming out into the open sooner than necessary, and so men will collect in large numbers in the salients. This is one of the few cases, I think, in which land mines will be useful. A mine exploded at the right moment in one of these salients will have the effect of damping the ardour of the attackers, and if the dose can be repeated two or three times in approximately the same place, the salient will soon lose its charm.

Artillery.—I have pointed out already that guns may be used at clearings, being run up by hand. They can also, of course, be run up to the edge of the wood by the attackers. The Germans did this at the Niederwald, and it was the fire of these guns that enabled

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these troops to emerge from the copse and advance against Elsasshausen. But wood fighting is uncertain at best, and the tide of battle ebbs and flows with bewildering rapidity, so that guns may find themselves suddenly stranded, unless great care is taken. Clery says :—" The uncertainty of wood fighting is always so great, that pushing guns very far forward would be attended with danger."

Fortification.—As regards the fortification of a wood, a few words may not be out of place. Generally speaking much time and labour will be required to make a satisfactory job of the fortification of a wood, and time will not often be available. As a rule, in the strictly limited time which will usually be at one's disposal, it will be best to devote one's energies to improving the communications. Since the greatest difficulty of wood fighting is due to the disorder that the passage of the wood entails, anything to assist the passage through the wood will be of great utility. This principle is in fact laid down in *Military Engineering*, Part I., § 281, together with certain other practical points. R.E. companies will usually be required to assist in placing a wood in a state of defence, as the number of cutting tools carried by the infantry is so very limited. When the front edge of a wood is entrenched, overhead cover should, if possible, be provided so as to guard against the heavy shrapnel fire to which the occupants of the trench will be subjected. Frequent traverses will also be necessary so as to localize the effect of any high-explosive shell that may pitch in the trench. I have already referred to the ways in which the rear edge may be treated.

The Americans in 1864 made defensive works in the woods of the Wilderness, whenever they halted. This, however, could not be done so easily nowadays, as the greater penetrative power of the modern bullet necessitates a far greater thickness of breastwork. The Germans, French, and Austrians did little in the way of fortification.

Sundry Points.—The following further points are worth considering very briefly. Firstly, the commander of a force fighting in a wood can exercise little or no control over his troops. A great deal must be left to the subordinate commanders and to the individual private soldier. This emphasizes the value of men who think for themselves and are prepared to act for themselves. The French soldier is, I suppose, second to none in this matter, and General Du Cane in an article in the *Army Review* says :—" The French have claimed considerable superiority in this form of fighting, and their claim appears to be fully justified. They attribute their superiority to the fact that their troops were self-reliant, resourceful and imbued with initiative." Troops must be taught to rally to any officer or N.C.O. in whose neighbourhood they happen to find themselves.

The Unknown.—Again, a wood hides the movements and presence of troops in it. Since the terror of the unknown is a very potent

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factor in the human temperament, defenders can, with a very small outlay of force, cause their enemy much disquiet. Imagine a large body of troops (say a division) approaching a large wood through which it intends to advance. A few companies of the other side may cause the division to waste much time in deploying for the attack, as they cannot know whether the wood is held by 100 or 10,000 men. As the troops work through the wood they will be seeing an enemy behind every tree, and crouching in every bush, and their frame of mind will be such that a panic will easily occur. This is really the reason why counter-attacks in woods are so very effective.

Shooting Wrong People.—Another point is the extreme danger in wood fighting of shooting one's friends. Jackson was killed in this way at Chancellorsville, and Longstreet was wounded a year later near the same place. This is a point to which a great deal of care will have to be devoted, and it is a question whether some means should not be adopted of distinguishing friend from foe as in night operations.

Surprise.—Another point is that extensive woods facilitate surprise. On May 12th, 1864, Edward Johnson's division was surprised by the Federals and 3,000 of them were captured. In a wood, far greater precautions against surprise will have to be taken than in open country.

Flanks.—Lastly, in wood fighting the flanks are the points of danger. The tendency of both sides always seems to be to edge away to a flank. Both Federals and Confederates did this at the Wilderness, and the local knowledge of the latter enabled Longstreet to bring off a very fine turning movement against Hancock's flank, which was only spoilt by Longstreet's untimely wound.

Summary of Tactical Lessons.—We may now summarize the tactical lessons I have attempted to deduce, and so see what is the proper use to which woods may be put in a modern battle.

In the first place we see that woods may be very tenaciously held by a comparatively small number of well-trained troops, even though subjected to a combined onslaught of infantry and artillery. They will therefore be suitable for that part of the battlefield where passive defence only is intended.

Secondly, they exert a peculiar attraction on all troops in the vicinity. For example we may quote again the wood of Maslowed where two Austrian corps were drawn out of their proper places into the fight with the 7th Prussian Division. They are therefore very suitable as advanced posts in front of a defensive line, as they will go a very long way towards breaking up the enemy's attack. The wood near La Folie was held by the French in this way at the Battle of Gravelotte.

For the same reasons woods form suitable pivots, as they enable

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the garrison to engage the attention of considerably larger forces of the enemy. To quote an extract from the *R.E. Journal* of August, 1911, the writer speaking of these pivots says :—" Their business is not to repulse attacks but to encourage them, and to be a terror to the neighbourhood; to be a hornets' nest when stirred with a stick, and yet able to roll themselves up into the prickliest ball of a hedgehog that ever baffled a pack of terriers." I think that woods fulfil these conditions better than most other localities.

Training.—But no success in wood fighting can be gained without good peace training. This is perhaps of greater importance in the case of woods than in other things. Here the private soldier must often act on his own, and he cannot be expected to know what to do from the light of nature. He must be taught. It is only by means of a thorough training that he will gain that self-confidence which is so absolutely indispensable to this kind of fighting, and no amount of bravery on his part will make up for lack of training. Presumably we train our men sufficiently in this work, but we must bear in mind that the great continental armies have had much war experience in countries where woods are very numerous, and have distinguished themselves in this kind of fighting a generation ago. Our army has not had any experience in wood fighting against a modern civilized army for nearly 100 years, and so it would seem that we have a considerable amount of ground to make up.

Effect on Strategy.—Woods have, in the past, excited very considerable influence on the strategy of a campaign—and I think that their influence on strategy will be still greater in the future. By "woods" I now mean of course large tracts of wooded country, and not mere isolated patches of woodland. Aeroplanes are likely to minimize the chance of surprise in modern war, and it will very often be found that the only chance of effecting a surprise is by operating in woods. Just as, tactically, woods favour the defence, so in strategy they assist the weaker side. The fighting in the Wilderness is a proof of this. Lee deliberately chose this ground for his operations, as his army was very much smaller than the Federal Army, and he hoped by protracting the fighting to make his opponents tire of the war. In this he nearly succeeded.

Forest of Orleans.—The Forest of Orleans also had a considerable effect in 1870 on the German strategy. We see Prince Frederick Charles sitting down in front of it, and not showing a great deal of keenness to enter it. His views about this forest can be clearly seen from an extract from a letter he wrote to the King on November 26th. He says :—" But far more difficult than this question is that of driving the enemy out of the Forest of Orleans. If the Emperor Napoleon III. said with truth he had never been able owing to the numerous cavalry which covered my advance to the Moselle, to find out where the main body was, so can I say the same

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as respects my own situation now. I only know with certainty that this or that village or farmhouse is occupied—where some large bodies of troops are, is also occasionally known: where the main body of the army is, I do not know."

The King of Prussia writing to Moltke on the 2nd December said:—"The great Forest of Orleans keeps us in doubt as to what the enemy is doing."

This uncertainty might have had very dire results, and it was only thanks to Moltke's determination, that Prince Frederick Charles was instructed to advance through the forest. He did it, though he did not like doing so.

Alvensleben, commanding the III. Corps, referring to this advance subsequently said:—"I went, I was fully aware, into a den, of which the door closed of itself after my last man had passed Chilleurs. With every step forward diminished any chance of support and also the possibility of withdrawing or of sending any news about myself or of receiving news. No use was there in previous calculations and speculations. I knew nothing as to the state of affairs south of this forest. Of only one thing was I sure, the impossibility of employing all my guns. And was it quite out of the question that the Prince's attack might be repulsed, that I should be for one or two days in front of the Bridge Head and with the enemy on my line of retreat? In this case we should certainly hold out, but my corps could hardly escape a catastrophe."

The French did not take advantage of the possibilities of success provided for them by the Forest of Orleans. It is interesting to speculate what would have happened if Lee had commanded them.

In conclusion, it seems that strategically large forests favour the weaker side, and enable it, through the concealment afforded, to assume the offensive under favourable conditions, and give it a chance of achieving decisive success. It requires a commander of very strong character to bring to a successful issue any campaign in this sort of country. Any weaker man than Ulysses S. Grant would have been beaten by Lee in 1864.

The worst thing one can do is to stand still. This gives the enemy time to execute his plan against a flank. This was Hooker's great mistake at Chancellorsville. A commander must keep moving, as this movement will, if it does nothing else, upset the enemy's aim by putting his opponents in a place where he does not expect them to be.

Lastly in wood fighting, more perhaps than in any other kind, salvation lies in taking the offensive, and so anticipating the enemy. A defensive attitude engenders all sorts of fears, such as those that beset the King of Prussia and Prince Frederick Charles, and thus greatly increases the danger of ultimate defeat.

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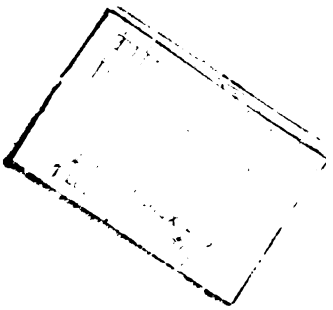

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

ARMY OF INDIA MEDAL. 1803-26.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

(*Continued*).

By MAJOR H. BIDDULPH, R.E.

THE ARMY OF INDIA, 1803–26.

In 1847–8 the issue of a medal and clasps was authorized by the Queen to the survivors of the army who had served at those battles, sieges, etc., from 1806—1814, for which gold medals had been granted at the time to the general and commanding officers engaged. The only service included in this list in which troops from India had been engaged was the expedition to Java, 1811. Consequently, in 1851, a medal was authorized to those surviving soldiers, European and Native, who had served at certain battles, sieges, etc., in India from 1803—1826, as set forth below, with the following exceptions, viz. :—Such native soldiers as had received the medal for the Nepaul War, granted at the time by the H.E.I.C.S., were ineligible for the Queen's medal and clasp for this campaign ; and for the same reason no native was eligible for the Queen's medal and clasp for " Ava."

It will be noted that the date on the medal is 1799—1826, whereas the services for which it was granted were between 1803—1826. The reason for this discrepancy is that originally it was intended to include the Mysore War and Capture of Seringapatam in 1799 in the list of services for which the medal would be granted ; but it was pointed out that the H.E.I.C.S. had granted medals at the time to *all* ranks, both European and Native. This service therefore was struck out of the list, and authority given for troops in the service of the Crown to wear that medal on all occasions, but the date on the new medal die escaped observation.

Medal to the Army of India, 1799—1826. (1803–26). *Authorized* 1851.

1·4-in. diameter. Silver.

Obverse.—Crowned head of Queen Victoria.
Legend : " Victoria Regina."

Reverse.—Victory seated beside a palm trèe and trophy.
Inscription : " To the Army of India, 1799—1826."

Ribbon.—Pale blue, 1¼ in. wide.

Mounting.—Silver scroll bar and swivel.

Clasps.—Allighur, Battle of Delhi, Laswaree, Defence of Delhi, Battle of Deig, Capture of Deig, Assye, Asseerghur, Argaum, Gawilghur, Nepaul, Kirkee, Poona, Kirkee and Poona, Corygaum,

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Seetabuldee, Nagpore, Seetabuldee and Nagpore, Maheidpoor, Ava, Bhurtpoor.

The medal rolls for the Europeans of the Queen's troops exist practically intact, though there is a strong suspicion that a few names may be missing. The reason of this is that claims came in piece-meal from 1851 to 1858, and the rolls were made up in batches, some of the later rolls containing a few names only. It is probable that some rolls containing a few names were mislaid before they were bound.

For the Europeans in the Company's service no proper medal roll exists; only a rough book of issues, which is almost certainly incomplete, although perhaps the entries omitted are few. The original rolls are probably in India. For the Native troops, such rolls as exist are to be found for the most part in India, and as (for the reasons stated above) they are to be numbered in dozens, were scattered over seven years, and emanated from different Presidencies, the verification of a Native's medal is more a matter of luck than anything else.

One thing, however, is certain, viz.; that practically every medal issued to a native, was sent out to India unengraved; and in that country some were rudely punched, others engraved, and probably a good number were issued plain.

Subject to the above remarks the following brief notes on the Army of India medal and the campaigns for which it was granted, may be of interest:—

Medal to the Army of India.

(i.). *Lake's Campaign*, 1803–4.

8th Light Dragoons	..	42	medals	issued	(officers & men)
27th ,, ,,	..	20	,,	,, ,, ,,	
29th ,, ,,	..	14	,,	,, ,, ,,	
22nd Foot	.. ..	8	,,	,, ,, ,,	
76th Foot	.. ..	31	,,	,, ,, ,,	
H.E.I. Co.'s Service	..	52	,,	,, *to Europeans* (officers & men)	

(ii.). *Wellesley's Campaign*, 1803.

19th Light Dragoons	..	13	medals	issued	(officers & men)
74th Foot	.. ..	20	,,	,, ,, ,,	
78th Foot	.. ..	37	,,	,, ,, ,,	
94th Foot	.. ..	40	,,	,, ,, ,,	
H.E.I. Co.'s Service and miscellaneous	.. ..	27	,,	,, *to Europeans* (officers & men)	

(iii.). *"Kirkee and Poona."* Single bar.

65th Foot	.. ..	16	medals	issued	(officers & men)
H.E.I.C. Service (Europeans)	.. .. ..	71	,,	,, ,, ,	

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(iv.). "*Poona.*" Single bar.

65th Foot	44	medals issued (officers & men)
H.E.I.C. Service (*Europeans*)	32	,, ,, ,, ,,
"*Poona,*" "*Ava*" ..	5	,, ,, .. ,,
"*Poona,*" "*Bhurtpoor*" ..	1	,, ,, .. ,,

(v.). "*Maheidpoor.*" Single bar.

22nd Light Dragoons ..	28	medals issued (officers & men)
1st Foot	12	,, ,, ,, ,,
H.E.I.C. Service and Miscellaneous (*Europeans*)	83	,, ,, ,, ,,
"*Maheidpoor,*" "*Ava.*"		
1st Foot	19	,, ,, ,, ,,
H.E.I.C. Service (*Europeans*)	18	,, ,, ,, ,,

(vi.). *Nagpore.* Single bar.

1st Foot —	40	medals issued (officers & men)
H.E.I.C. Service (*Europeans*)	43	,, ,, ,, ,,
"*Nagpore,*" "*Ava.*"		
1st Foot	43	,, ,, ,, ,,
H.E.I.C. Service (*Europeans*)	5	,, ,, ,, ,,

(vii.). "*Nagpore,*" "*Maheidpoor,*" four medals issued to Europeans (officers and men).

"*Nagpore,*" "*Maheidpoor,*" "*Ava,*" three medals issued to Europeans (officers and men).

"*Nepaul,*" "*Maheidpoor,*" one medal issued to Europeans (officers and men).

"*Nepaul,*" "*Nagpore,*" four medals issued to Europeans (officers and men).

"*Nagpore,*" "*Bhurtpoor,*" one medal issued to Europeans (officers and men).

(viii.). The *total* number of certain rare clasps, issued singly, and in combination with others, to Europeans and Natives, appears to be as follows :—

"*Seetabuldee and Nagpore,*" 20 Europeans and 194 Natives.

"*Corygaum.*" Single bar. 8 medals in all.

"*Poona,*" "*Corygaum,*" 10 medals in all.

"*Kirkee and Poona,*" "*Corygaum,*" 64 medals in all.

"*Asseerghur,*" "*Kirkee and Poona,*" "*Corygaum,*" 1 medal.

The information about certain other rare clasps is somewhat indefinite, for it is not clear how many Natives received them. For instance, it is possible that a good many received the clasp "Kirkee" who were survivors of the 1st (Dapuri) Battalion, Peishwa's Brigade

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Poona Auxiliary Force (afterwards the 23rd Bombay N.I.), which was engaged at the Battle of Kirkee, but not at the Battle of Poona, but the available records of any such issues are very indefinite. Only one man of the 65th Foot received the clasp "Kirkee," and this medal is in Lord Cheylesmore's collection. Another man of the 65th Foot received the two clasps "Poona," "Corygaum"; this medal came into Dr. Payne's possession, but the "Corygaum" clasp was removed, owing to a most unfortunate misapprehension, and the medal has been irretrievably damaged.

I am not aware that there exists in any collection *genuine* specimens of medals with the clasps "Seetabuldee" or "Defence of Delhi"; while to my certain knowledge several medals with fraudulent "Corygaum" bars have been sold in recent years, and fetched very high prices.

The numbers of medals issued for "Nepaul," "Ava" and "Bhurtpoor" are too numerous to require cataloguing. The number of naval recipients of the medal and clasp for "Ava" will be given later.

MAHRATTA WAR, 1803–5.

This war was occasioned by the jealousy of the Mahratta confederation at the expanding influence of the British power.

Scindia, Maharajah of Gwalior, and Bhoonsla, Rajah of Berar, were the two foes opposed to the British at the moment; and the operations may be roughly divided into those conducted by General G. Lake, with the Grand Army, in the Doab, and those conducted by Major-General the Hon. A. Wellesley (and Colonel James Stevenson, commanding the Hydrabad Subsidiary Force), in the Deccan. Minor operations in Cuttack and Bundelkhund were undertaken by small detached forces.

Lake's Operations, 1803.

The Grand Army was directed to concentrate at Secundra on the 26th August, 1803,* and on the 27th (before the concentration was complete) Lake marched. On 29th August, an insignificant cavalry skirmish took place at Coel, before Allighur, which ended in the retreat of the Mahratta cavalry under Fleury, a Frenchman, who thereupon made a raid on Shekoabad, in British territory.

On the 3rd September Lake determined to seize by a *coup de main* the fort of Allighur, which was held by a garrison of several thousand men under the command of M. Pedron, son-in-law to M. Perron, Scindia's French Commander-in-Chief.

The assaulting party was composed of four companies H.M. 76th Foot, supported by the 1-4th N.I. and four companies 2-17th N.I., under the command of Brigadier the Hon. W. Monson, 76th Foot. The surprise, which was timed for 4.30 a.m. failed, and the assaulting party thereupon tried to escalade the walls; a fruitless

* For composition of force see later on.

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attempt carried on for a long time under a heavy fire at a few yards range. The 2-4th N.I. was pushed up to reinforce them, and two 12 prs. sent for, with which the gate was blown open ; three successive gates had to be forced before an entrance into the main fort could be effected. Once inside the fort, the British troops cleared it out and some 2,000 Mahrattas were killed. The British casualties were also heavy, numbering 265 in all, including 6 British officers and 21 Europeans killed, and 11 British officers and 71 Europeans wounded ; the chief sufferers being the 76th Foot, who lost 9 officers and 66 men, and by whose valour the fortress was captured. That night Lake received news of the raid on Shekoabad referred to above, and immediately despatched the 3rd Cavalry Brigade (29th Light Dragoons, 1st and 4th Bengal Light Cavalry) to repel the incursion and relieve Shekoabad which was held by five companies 1-11th N.I. with one gun 2-1st Battalion Artillery.

The 1-4th N.I. was left to garrison Allighur, and without waiting to strengthen his weakened force, Lake pushed on, and on 11th September, near Delhi, encountered the enemy, 19,000 men with 100 guns, under M. Louis Bourquien who had succeeded Perron as Scindia's Commander-in-Chief.

The enemy held a strong position with both flanks resting on swamps ; Lake reconnoitred personally (as was his custom) with the cavalry, and then slowly retreated masking the approach of his own infantry and inducing the enemy to advance. The cavalry then opened out and let the infantry advance, who, in the face of the heaviest fire, continued their march until within a hundred paces of the Mahratta line, when they shattered it with a volley and a charge.

The British casualties, including two officers killed by sunstroke, were 486, of which the European portion was 6 officers and 47 men killed, 10 officers and 127 men wounded. The 76th Foot again bore the brunt and, as ever, were the backbone of the army ; their losses totalled 138. Their commanding officer was Capt. W. Boyes, all the senior officers having been knocked out at Allighur ; but Major W. Macleod, though wounded on that occasion, was present at the Battle of Delhi in his palanquin. The Mahrattas lost 68 guns and over 3,000 men, and on the 14th September M. Bourquien and other French officers surrendered as prisoners. The 2-4th and four companies 2-17th N.I. were left in garrison at Delhi ; Lieut.-Colonel D. Ochterlony, an officer soon to become famous in the annals of the Indian Army, being appointed Resident. In October, Lake was reinforced by the arrival of the remainder of his detached troops, including the 8th Light Dragoons ; and on the 4th October he commenced operations against Agra, which capitulated on the 17th ; the casualties numbered 230, confined to the Staff, Artillery, and Native infantry regiments. The treasure captured in Agra amounted to 22 lakhs of rupees. The 2-2nd N.I. was left to garrison the place, and on 27th October Lake marched with the rest of his men against

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a large force summoned by Scindia from the Deccan to recover Delhi. On 29th October Lake left all his heavy guns and baggage at Fattehpur Sikri under guard of the 1-2nd and 1-14th N.I. and pushed on by forced marches. He overtook the Mahrattas near Laswaree on 1st November, and attacked them in a heavy dust storm with his cavalry, with indifferent success. When the tired infantry arrived on the field at mid-day, Lake attempted to turn the enemy's right flank, but the Mahrattas changed front with rapidity and ease ; and the leading column headed, as usual, by the 76th Foot suffered severely. Led by Lake and Major-General C. Ware they pressed their attack home, and with the aid of the cavalry turned the defeat into a debacle. 7,000 Mahrattas were left dead on the field, and 72 guns were taken. The British casualties numbered 824, 15 British officers and 82 Europeans being killed, and 27 British officers and 282 Europeans being wounded ; the 76th Foot contributing no less than 213 to the total. Lake had one or two horses shot under him ; while Major-General Ware and Colonel T. P. Vandeleur, commanding the 1st Cavalry Brigade, were killed.

These victories, backed up by those in the Deccan (to which reference will be made later) and minor successes elsewhere, compelled Scindia and Bhoonsla to make peace. But to watch Holkar, Lake detached a column of Native troops under Monson to protect Jeypore, while he himself withdrew to Agra for the coming hot weather.

Monson's operations ended in complete disaster ; advancing too far, he was compelled to retreat in the middle of the rains before Holkar's vastly superior forces. The retreat ended in a disordered flight, and the draggled remnants of his force reached Agra on 31st August, 1804, after a constant retreat of 350 miles. This rout compelled Lake to take the field in person once more.

On 1st October Lake marched from Agra, his first objective being Delhi, which was being attacked by Holkar's infantry and artillery. The defence of the city and fortress of Delhi from 7th—15th October by two and a-half battalions of N. Infantry and some 2,000 irregulars (many of whom deserted), was an extraordinary military feat ; the more so, as the defenders had no regular artillery. A gallant sortie under Lieut. J. Rose, 2-14th N.I., later Lieut.-General Sir J. Rose, K.C.B., on 9th October, was completely successful, the breaching guns being spiked ; and the repulse of an assault on the Lahore Gate on the 14th, combined with news of Lake's advance compelled the enemy to raise the siege. Lake relieved Delhi on the 17th and after strengthening the garrison finally decided to pursue Holkar's immense force of cavalry with his own cavalry, horse artillery and reserve, while Major-General J. H. Fraser with two regiments of native cavalry, the artillery, and three brigades of infantry marched toward Deig against Holkar's infantry and artillery. For nearly three weeks Lake pursued Holkar's cavalry ; at last leaving his reserve behind, he marched by night with his six regiments of cavalry

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and one troop of horse artillery, and surprising Holkar's camp in the morning (17th November) at Farruckabad, defeated him with fearful slaughter. The pursuit continued for miles, and no less than 3,000 Mahrattas were killed, the British losses being 3 men killed, 25 wounded, and 75 casualties among the horses. This crushing defeat finished off Holkar's cavalry; and meanwhile Fraser had finished off his infantry and artillery; reinforced on 10th November by a detachment of the Bengal European Regiment, he attacked the enemy outside the fortress of Deig on the 13th. The 76th Foot, as usual, led the right and leading column; the troops forming for the attack at 3 a.m. The Mahrattas were defeated at all points, at least 2,000 were killed, 87 guns were taken, and the slaughter only ceased at 3 p.m., when the Fortress of Deig, which belonged to the Rajah of Bhurtpore, received the fugitives and opened fire on the British troops with its guns. The British casualties were 652, to which total the 76th contributed 153. General Fraser was mortally wounded, while leading the 76th Foot in the attack, and the command devolved on Monson.

Monson withdrew the army with the captured guns to Muttra, where Lake joined him; and on the 11th December, after the arrival of a battering train, the army marched to the Siege and Capture of Deig. On the 13th the place was invested, and at midnight, 23rd—24th December, the breach was stormed, the 22nd, 76th and Bengal European Regiment forming the bulk of the assaulting troops. The casualties at the successful assault were 225 (and during the siege about 90). The citadel fell the next day, and leaving the 1-4th N.I. in garrison, Lake marched on 28th December to the Siege of Bhurtpore. Although strengthened by the 75th Foot and troops from Bombay, the four assaults delivered in January and February, 1805, were uniformly unsuccessful, due to an insufficient battering train, and want of care and deliberation in the siege. Lake was however undeterred, and the Rajah of Bhurtpore seeing that it would be merely a matter of time, made overtures of peace, which were accepted. The total casualties before Bhurtpore were over 3,000 men; the 76th Foot lost 16 officers and 188 men, and other European regiments fared as badly.

The corps actually present at the foregoing battles, etc., are given below, as also a list of *some* of the Engineer officers engaged.

MAHRATTA WAR, 1803–5.

(1). *General G. Lake's Campaign, August,* 1803—*March,* 1804.

The Grand Army was composed as follows:—

Commander-in-Chief's personal escort, one company, 1-11th Bengal N.I.

Cavalry Division:—Colonel W. St. Leger, 27th Light Dragoons.

1st Brigade:—Colonel T. P. Vandeleur, 8th Light Dragoons.

H.M. 8th Light Dragoons.

1st and 3rd Bengal Light Cavalry.

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2nd Brigade :—Colonel W. St. Leger, 27th Light Dragoons (commanding the Division).
H.M. 27th Light Dragoons.
2nd and 6th Bengal Light Cavalry.
3rd Brigade :—Colonel R. Macan, Bengal Cavalry.
H.M. 29th Light Dragoons.
4th Bengal Light Cavalry.
Artillery and Park :—Lieut.-Colonel J. Horsford, Bengal Artillery.
1st, 2nd and 3rd Companies, 1st Battn.
1st, 2nd, 3rd and 4th Companies, 2nd Battn.
Engineers and Pioneers :—Capt. T. Wood, Bengal Engineers.
Infantry :—Right Wing :—Major-General C. Ware, H.E.I.C.S.
1st Brigade :—Lieut.-Colonel Hon. W. Monson, 76th Foot.
H.M. 76th Foot.
1-4th, 2-4th, and 4 Companies 2-17th Bengal N.I.
3rd Brigade :—Colonel J. McDonald, 15th B.N.I.
1-15th, 2-15th, and 2-12th Bengal N.I.
Left Wing :—Major-General Hon. F. St. John, H.M.S.
2nd Brigade :—Colonel E. Clarke, 9th Bengal N.I.
2-8th, 2-9th, 1-12th and 6 Companies 2-16th Bengal N.I.
4th Brigade :—Lieut.-Colonel J. Powell, 8th Bengal N.I.
1-2nd, 2-2nd, 1-14th Bengal N.I.

Troops Present at the Storm of Allighur, 4th September, 1803.

2 Brigades of Cavalry, brigaded as under:—
2nd Brigade :—H.M. 27th Light Dragoons, 2nd and 3rd Bengal Light Cavalry.
3rd Brigade :—H.M. 29th Light Dragoons, 1st and 4th Bengal Light Cavalry.
Artillery, Engineers and Pioneers.
1st, 3rd, and 4th Infantry Brigades, as given above.

The 1st Infantry Brigade, with details of artillery, etc., were alone actively engaged, though the 27th Light Dragoons also sustained slight casualties.

Casualties :— 6 British officers and 21 Europeans killed.
11 ,, ,, 71 ,, wounded.
Total casualties, including Natives, 265.

N.B.—The 8th Light Dragoons were on the march up from Cawnpore, the 6th Bengal Light Cavalry were in charge of a convoy marching to join the army, and the 2nd Infantry Brigade was detached near Anupshahr.

Early on 5th September Colonel Macan with the 3rd Cavalry Brigade (29th Light Dragoons, 1st and 4th Bengal Light Cavalry) was ordered to Shekoabad to repel an incursion into the provinces; the 1-4th Bengal N.I. was left in garrison at Allighur, and the army (thus reduced) moved forward.

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Troops Present at the Battle of Delhi, 11th September, 1803.

The 2nd Cavalry Brigade :—H.M. 27th Light Dragoons, 2nd and 3rd Bengal Light Cavalry.
Artillery, Engineers and Pioneers.
The 1st Infantry Brigade, less the 1-4th Bengal N.I.
The 3rd and 4th Infantry Brigades.

The 4 Companies 2-17th Bengal N.I. (1st Brigade) formed the camp guard and sustained no casualties.

The 6th Bengal Light Cavalry, with its convoy, got into touch with the rear guard of the army on the evening of the 10th September, and remained on the 11th September in charge of this convoy ; but survivors received the clasp for the " Battle of Delhi " in 1851. Total casualties, 486, of which the European losses were 6 officers and 47 men killed, 10 officers and 127 men wounded, and 8 men missing. 68 guns were captured.

The 2-4th and 4 Companies of 2-17th Bengal N.I. were left in garrison at Delhi.

Between the 2nd and 12th October, the 8th Light Dragoons, Macan's Cavalry Brigade (29th Light Dragoons, 1st and 4th Bengal Light Cavalry) and the 2nd Infantry Brigade (Colonel E. Clarke) joined the army ; and the cavalry being now united was brigaded as shown on page 93 ; Colonel T. P. Vandeleur succeeded St. Leger as senior cavalry officer, when the latter quitted the army on 27th October.

After the capitulation of Agra, 17th October, 1803, the 2-2nd Bengal N.I. was left in garrison there, and on 29th October the 1-2nd and 1-14th Bengal N.I. were left at Fatehpur Sikri with the heavy guns (probably 2nd, 3rd, and 4th Companies, 2nd Battalion Artillery) and baggage.

Troops Present at Laswaree, 1st November, 1803.

The 3 Cavalry Brigades (8 regiments).
Artillery (less the Companies at Fatehpur Sikri), Engineers, Pioneers.
Infantry, H.M. 76th Foot, and the 2nd and 3rd Infantry Brigades.

The casualties were 824, of which the European were 15 officers and 82 men killed, 27 officers and 282 men wounded. 72 guns were captured.

Colonel J. McDonald, 15th Bengal N.I., succeeded Major-General C. Ware, and Colonel R. Macan succeeded Colonel T. P. Vandeleur, both these officers having been killed.

The cavalry brigadiers were:—1st Brigade:—Colonel T. P. Vandeleur (and senior officer). 2nd Brigade:—Lieut.-Colonel J. O. Vandeleur. 3rd Brigade :—Colonel R. Macan.

Lieut.-Colonel J. Gordon, 1st Bengal Light Cavalry, succeeded to the command of the 1st Brigade.

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(2). *Lake's Campaign, September, 1804—March, 1805.*

Cavalry Division :—Colonel R. Macan.

1st Brigade :—Lieut.-Colonel J. O. Vandeleur, 8th Light Dragoons.
H.M. 8th Light Dragoons.
2nd, 3rd, 6th Bengal Light Cavalry.

2nd Brigade :—Lieut.-Colonel T. Browne, 2nd Bengal Light Cavalry.
H.M. 27th and 29th Light Dragoons.
1st and 4th Bengal Light Cavalry.

Horse Artillery :—*Experimental Troop. Capt. C. Brown.

Infantry Divisions :—Major-General J. H. Fraser, H.M.S.

1st Brigade :—Lieut.-Colonel Hon. W. Monson, 76th Foot.
H.M. 76th Foot.
1-2nd and 1-4th Bengal N.I.

2nd Brigade :—Lieut.-Colonel G. S. Browne, 4th Bengal N.I.
1-15th, 2-15th, 1-21st Bengal N.I. (6 Companies).

3rd Brigade :—Lieut.-Colonel G. Ball, 8th Bengal N.I.
1-8th, 2-22nd Bengal N.I. (7 Companies).

Reserve :—Lieut.-Colonel P. Don, 15th Bengal N.I.
Flank Companies, H.M. 22nd Foot.
1-12th, 2-12th and 2-21st Bengal N.I.

Artillery :—Lieut.-Colonel J. Horsford.
1st, 2nd, and 3rd Companies, 1st Battalion.
1st, 3rd and 4th Companies, 2nd Battalion.

Engineers, Pioneers :—Capt. J. Robertson, Bengal Engineers.

On 1st October Lake marched from Agra, and on the 16th relieved Delhi.

Defence of Delhi, 7th—15th October, 1804.

Resident :—Lieut.-Colonel D. Ochterlony, 12th Bengal N.I.

O.C. Troops :—Lieut.-Colonel W. Burn, 2-14th N.I.

Garrison :—2-4th, 2-14th and 4 Companies 2-17th Bengal N.I.

Capt. Harriott's Battalion.
Lieut. Birch's Battalion.
Lieut. Scott's Najibs.
Irregular levies.
} Irregular Troops, a number of whom deserted.

The garrison was reinforced by the 1-21st N.I.; and the 2-14th N.I., with two corps of irregular infantry, marched for Saharanpur, but was attacked by Holkar at Shamli.

On 31st October Lake marched from Delhi to Burn's relief and in pursuit of Holkar with all the cavalry (except the 2nd and 3rd Light Cavalry), the Horse Artillery, and the Reserve under Lieut.-Colonel Don, with six guns and two howitzers. After 16 days' continual marching, Lake left the Reserve and heavy guns behind, and marching by night with his six regiments of cavalry and troop of horse artillery, cut Holkar's army to pieces on the early morning of 17th November. His casualties were only 3 men killed and 25 wounded, so sudden was the surprise and complete the defeat of Holkar.

* Afterwards 1st Troop, 1st Brigade, Bengal Horse Artillery.

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Meanwhile on 5th November Major-General Fraser marched from Delhi with the 2nd and 3rd Light Cavalry (Lieut.-Colonel T. Browne), the Foot Artillery, 1st, 2nd, and 3rd Infantry Brigades (less the 1-21st N.I. left near Delhi), Engineers, Pioneers and Hearsey's Irregular Cavalry, towards Deig against Holkar's infantry and heavy guns.

On the 10th November he was reinforced by a detachment of the Bengal European Regiment (350 strong) at Goburdan, and early on the 13th November attacked Holkar's army outside the Fortress of Deig.

Troops Present at the Battle of Deig, 13th November, 1804.

Cavalry :—Lieut.-Colonel T. Browne, 2nd L.C.
2nd and 3rd Bengal Light Cavalry.
Artillery :—
Engineers, Pioneers :— } as given above.
Infantry :—1st, 2nd, and 3rd Brigades as given above, less the 1-21st Bengal N.I. and plus the detachment of Bengal European Regiment, added to the 2nd Brigade.
Hearsey's Irregular Cavalry.

Casualties :—652 in all ; of which 6 British officers and 57 Europeans were killed, 16 British officers and 189 Europeans wounded and 12 missing. Fraser was mortally wounded, and died at Muttra on 24th November. 87 guns were captured.

The Fortress of Deig opened fire on the British, and Monson withdrew the army to Muttra, with the captured guns, where Lake joined him with his troops from Farruckabad on 28th November, and on the 11th December, after the arrival of a battering train, the whole army marched to invest Deig.

Troops Present at the Siege and Capture of Deig, 11th—25th December.

The whole army, as enumerated above, less the 1-21st N.I. The casualties during the siege were about 90, of whom two British officers were killed ; at the assault on 23rd—24th December, they were 225, of whom two other British officers were killed.

Assault on Deig, Midnight, December 23rd—24th, 1804.

Right Column :—Capt. S. Kelly, European Regiment.
4 Battalion Companies European Regiment.
5 Companies 1-12th Bengal N.I.
Left Column :—Major J. Radcliffe, 1-12th Bengal N.I.
4 Battalion Companies European Regiment.
5 Companies 1-12th Bengal N.I.
Centre Column :—Lieut.-Colonel K. Macrae, 76th Foot.
Flank Companies H.M. 22nd and 76th Foot, and European Regiment, also 1-8th Bengal N.I.

A proportion of artillery, engineers and pioneers accompanied the assaulting columns.

The citadel capitulated on 25th December ; the 1-4th Bengal N.I. and Hearsey's Irregulars were left in garrison at Deig, and Lake marched on to his unsuccessful siege of Bhurtpore.

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Casualties in action of the British Infantry :—

	Killed.		Wounded.	
	Offrs.	Men.	Offrs.	Men.
4th Sept., 1803—21st Feb., 1805. H.M. 76th Foot..	13	177	22	611
23rd Dec., 1804—21st Feb., 1805. H.M. 22nd Foot (Flankers)	—	33	9	145
23rd Dec., 1804—21st Feb., 1805. Bengal European Regiment	—	45	14	206

N.B.—Casualties during the investment of Deig are not included, as they are not known.

Average monthly strengths of rank and file :—

	1. 9. 03 to 31. 3. 04	1. 9. 04 to 31. 3. 05.
H.M. 8th Lt. Dragoons ..	607 men	540 men.
„ 27th „ „ ..	358 „	321 „
„ 29th „ „ ..	370 „	331 „
„ 22nd Foot	200 (Flank Cos.)	882 „ (whole regt.).
Bengal European Regiment ..	588 „ „	331 „

1ST MAHRATTA WAR.

An Incomplete List of Engineer Officers engaged.

I. LAKE'S OPERATIONS.

Bengal Engineers.

Capt. Thos. Wood, Commanding Engineer, Storm of Allighur, Battle of Delhi, Capture of Agra, Battle of Laswaree, Reduction of Rampoora (1804).

Capt. Jas. Robertson, Battle of Deig, Siege and Capture of Deig, Siege of Bhurtpore (1805).

Lieut. H. W. Carmichael Smyth, Storm of Allighur, Battle of Delhi, Capture of Agra, Battle of Laswaree, Battle of Deig, Siege and Capture of Deig, Siege of Bhurtpore, Capture of Gohna (1806).

Lieut. Rd. Tickell, Battle of Deig, Siege and Capture of Deig, Siege of Bhurtpore (1805).

Ensign J. H. Jones, Siege of Bhurtpore. Killed at the assault of Fort Kamona, November, 1807.

Bombay Engineers.

Lieut. Wm. Cowper, Siege of Bhurtpore (1805). Chief Engineer with Bombay Force under Major-General Rd. Jones.

II. OPERATIONS IN ATTACK, UNDER LIEUT.-COLONEL GEO. HARCOURT.

Capt. J. T. Blunt, Bengal Engineers.

Lieut. W. Ravenshaw, Madras Engineers.

III. OPERATIONS IN BROACH UNDER LIEUT.-COLONEL H. WOODINGTON.

Capt. J. Cliffe (or Clift), Bombay Engineers.

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FORTRESS DEFENCE—CONVENTIONS OPPOSED TO THE OFFENSIVE SPIRIT.

By MAJOR J. C. MATHESON, R.E.

IN the April number of the *R.E. Journal*, Major Sewell deals with some conventions of permanent fortification opposed to the offensive spirit, and incidentally takes my Paper (*R.E. Professional Papers*, No. 3, Vol. III., 4th Series, "The Growth of the Offensive in Fortification") upon which to base his criticisms. With permission, I should like to reply to some of his remarks, as I cannot but consider that he has read into the pamphlet what is not there. It is to be regretted that the reply must be so belated, but that is accounted for by the distance of South America from England.

Major Sewell comes to the conclusion that the offensive spirit is only nascent in fortress design and has not yet attained to maturity. This cannot be wondered at. Indeed, when the history of the art is remembered, the progress made in the last 40 years is unprecedented.

Undoubtedly we are in agreement, as who is not, that "the offensive is the soul of defence." But in the case of a fortress it is often intended strategically to cover an offensive movement, while tactically it is obliged to cover a locality (*e.g.* a coast fortress). As Colonel Klein points out in his now well-known book, a *point d'appui* is the fulcrum of a movement and must be fixed. Therefore it seems that a fortress, which is a strategical *point d'appui*, must very often cover a locality in covering an offensive movement.

The fewer the number of men who are required to keep the fulcrum fixed, the more will be available to do the useful work on the lever. Now the object of fortification is to effect this economy. If the *points d'appui* or key-points, call them what you will (a prize should be given for an English word), are to be at an average interval of 8,000 yards (say 4½ miles), as Major Sewell recommends, it would seem that more men would be required to keep the fulcrum fixed, or in other words to defend the fortress, than if the *points d'appui* were closer together. The flanking fire from the *points d'appui* in ordinary accidented ground cannot be very great over this interval, especially in a night attack, and without the support of this flanking fire the mobile force of the garrison would be very much on an equality with the enemy.

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Major Sewell would seem to indicate that any works in an interval

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partake of the nature of a continuous line. It is not clear whence he obtains this idea. It is certainly not put forward by me. In the nature of things offensive movements on the part of a fortress garrison must be on a small scale and should be aided by the provision of a few trenches and obstacles to cover unseen ground, and to force the enemy into areas where he can be attacked with advantage. The quoted portions of the official manuals would seem to bear this out fully.

An objection is also made to the inclusion of "Fire of all kinds" amongst offensive methods. This seems hypercritical. The actual words of the pamphlet were "every effort must be made to bring into use to their fullest extent rifles, guns, and howitzers." Surely a defender who carries this out may be said to be doing something towards an active defence. The defender of Belfort was very keen on the development of fire.

Considerable criticism is expended upon the general design of a *point d'appui*. And first of all exception is taken to my choice of an example of ground for the siting of this work. But there was no choice if this particular fortress was selected. The site occurred in the line of defence and it had to be occupied. There would have been little advantage in choosing a flat site, it seemed better to select a site typical of English contours and presenting a few difficulties. It was impossible to go beyond the valley, and the latter could not be flanked properly, while it is not possible to cover a large area of ground by indirect fire when no observing stations are available. Therefore the best had to be made of the site.

As regards actual design Major Sewell says that "the solution would appear to lie in a reconsideration of the design of a fort, rather than in siting a fort of obsolete design on the reverse slope." Apparently this has reference to the "fort nucleus" shown in my example of a *point d'appui*. But I gave no design. On p. 45 of my paper I ventured to give the main requisites of a fort, and if these, fairly obvious, requisites are supplied the actual design of the fort need not be much criticized. One would rather have a bad fort on a good site than a good fort on a bad site. Surely the one thing that the history of fortification has pointed out is that niceties of design are of very little, if any, account.

He also objects to the rear crest position because he says it is a second line. This I most emphatically claim that it is not. The definition of a second line would seem to be a line on which the defenders of a front line would retire when they were beaten out of their first position. Here, there is no question of retiring from one line to another. The "fort nucleus" will have its own garrison from the commencement, and it forms the key-point of the group. No one is keener than myself against the idea of successive lines, but it finds many adherents on the Continent. Flogging dead horses is

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unprofitable work, but in rooting up weeds from a flower bed it is equally unprofitable to tear up all young shoots unless one is quite sure that they are weeds.

It is somewhat difficult to see very much difference between the organization of Major Sewell's group and that which I put forward. He proposes to have retired bombproof barracks with radial galleries to the front, and my proposal is very similar. The main difference would seem to lie in the position of the deep ditch obstacle. I propose to concentrate it round the fort nucleus, and he would apparently use it only in front of the front line trenches, but this is not very clear.

A great point is made against the "geometric trace" of a fort. By this I gather is meant a fort with straight lines on plan, since the idea of pentagons, etc., is prehistoric. I hold no brief for straight lines, as naturally one would follow the contours of the ground as much as possible. At the same time, considering the low command of a modern fort (especially on the rear crest) and the fact that the enemy's artillery will have ample time to get familiar with the shape of the fort whatever it is, it does not seem that straight or wavy lines will make much difference. The fort nucleus shown on the plate referred to was diagrammatic only.

In permanent fortification there is no reason why "engineered" slopes should be conspicuous. There are at least two forts, not unknown to R.E., possessing glacis which were "engineered" to a very large extent. At the present day those forts have an absolutely clear field of fire for at least 500 yards, and the glacis show no difference to the surrounding fields.

As regards "closed" works or "open" works, a distinction would seem to hold between the group and its *point d'appui* The group should not be a closed work, but its key-point should be.

Finally, Major Sewell runs a tilt with me as regards retrenchments. To make retrenchments when the front line seems to be falling is only human nature. It is the duty of a fortress to hold out as long as it is possible, even a day or two may make a difference in the event, it nearly did at Belfort. And a retrenchment may make this difference, and therefore it would seem to be advisable. There is no necessity why it should be a continuous line, it should not be, but it may afford very valuable assistance to the last reserve of the garrison in its (to-be-hoped-for) counter-attack. The garrison for the retrenchment would probably come from a portion of the last fortress reserve.

It is to be hoped that these remarks will not be considered as running counter to the original premise, that "the offensive is the soul of defence." The whole object of the Paper *The Growth of the Offensive in Fortification* was to try and prove its truth.

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MEMOIR.

COLONEL RICHARD HENRY JELF, C.M.G.

To the many friends of Richard Jelf, the news that he had passed away after a very brief illness at dawn on Saturday, the 26th of April, came as a great shock and with a feeling of profoundest regret. There will have been but one thought amongst his friends of all ranks in the Corps he loved so well, that a loyal servant of the King and the Corps, a great and good Christian, a very perfect gentleman, and a true friend has gone from amongst us to his rest. Our deepest sympathy is with her with whom every thought and interest of his life were one, and with his sons.

He had been living for some years since his retirement, at their home, Offcote Hurst, Ashbourne, in Derbyshire, the centre of his many activities ; and, in need of rest, he had gone for a visit to his old friends, Sir Richard and Lady Harrison, at Ashton Manor, near Exeter. Whilst there, he contracted a chill, and serious symptoms soon appeared. He had taxed his strength to the utmost with never a thought of self, and his powers of resistance were weakened. His condition became gradually worse, and in spite of the most skilful medical aid and devoted nursing, he passed quietly away. His death was one of the most beautiful ever witnessed, meeting it as he did with the reverent and fearless spirit of the true Christian soldier, and almost with his last breath, sending messages of love and comfort to all those dear to him on earth. He was buried at Ashbourne.

Born at Christ Church, Oxford, on the 2nd of February, 1844, he was the son of the Rev. Dr. Jelf, Principal of King's College, London, and Canon of Christ Church, Oxford. His mother, Countess Schlippenbach, was a maid of honour to the Queen of Hanover. Of his two brothers, one, whom many Royal Engineers will remember, was a man of singular saintliness and personal charm, Canon George Jelf of Rochester, afterwards Master of Charterhouse ; the other rose to considerable distinction as a Q.C., and retired in 1910, with the honour of knighthood, from the post of Judge in the King's Bench Division, a position he had held since 1901.

Richard Jelf was educated at Eton, and at King's College, London, of which he was a Fellow. He passed into the Royal Military Academy in 1863, and was commissioned as Lieutenant in the

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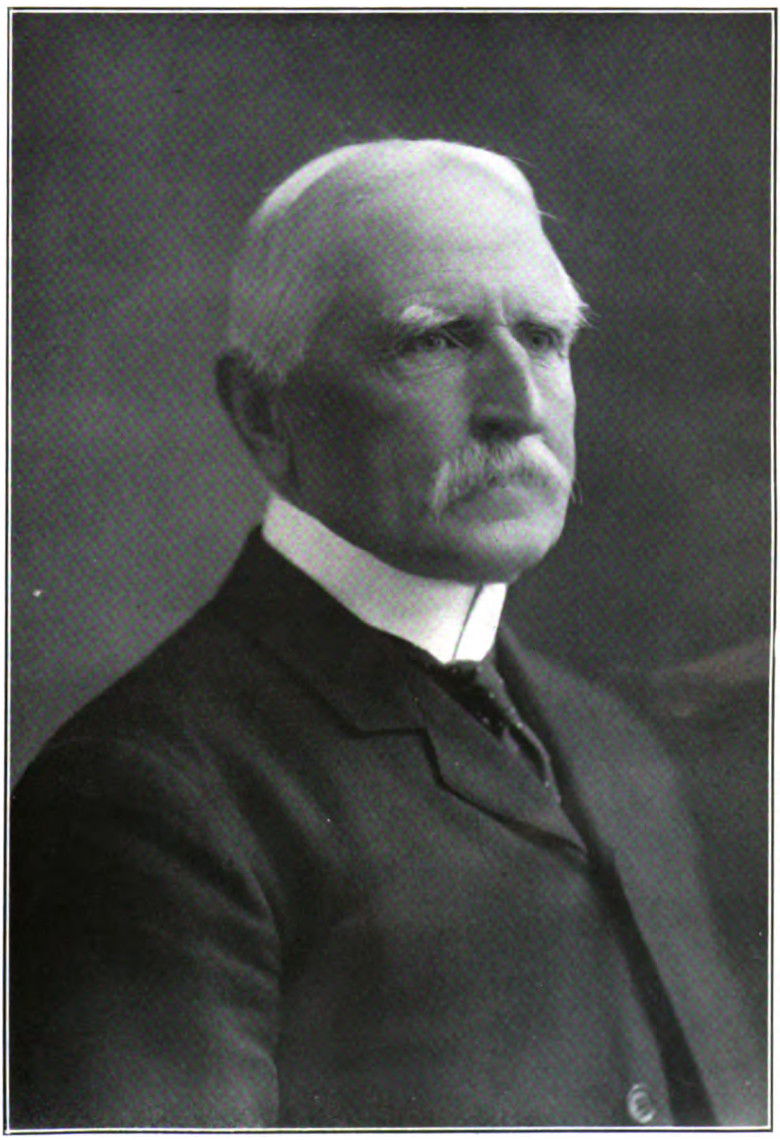

Colonel Richard Henry Jelf, C.M.G.

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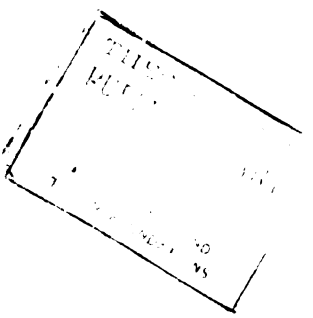

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Royal Engineers on the 22nd of June, 1865. He was then 21 years of age and those who knew him in those days, speak of him in terms which describe him all through his life. He was not only a very good officer, thorough in all his work and an ardent Sapper, but he had a charming personality, full of the *joie de vivre*, making hosts of friends, and filling his world with sunshine and laughter. Whatever he did, he did well.

He was a keen sportsman, and a first-rate oar. He stroked the four in the race between Seniors and Juniors at Chatham in 1866, and rowed many a hard course with Lieut. (now Colonel) C. F. C. Beresford, in a pair.

He and his inseparable friend, Lieut. M. Brackenbury (now Colonel), were the life and soul of the R.E. Dramatic Club. Of him, his friend writes: "No man ever had a truer friend. His cheeriness and sense of humour made him a delightful companion, but it was those who knew him well who were aware how kind-hearted and considerate he was."

One of his greatest friends of the Woolwich and Chatham days was J. J. Curling, one of those heroes of the Corps, whose unobtrusive devotion to duty is perhaps too little known by his brother officers. While yet a subaltern, Curling, filled with pity for, and keenness to help, the poor fisher people on the storm-bound coast of Newfoundland, laid down his Commission, took Holy Orders, and gave himself, his means, and his yacht, the *Laverock* (still flying the burgee and blue ensign of the Corps Yacht Club), to a service of devotion to those poor people, whose lives are filled with so much privation and sorrow. The friendship between Curling and Jelf was lifelong, and they had much in common in thought and ideal.

After finishing his course at the S.M.E., Jelf was ordered to Dover in November, 1867, and served there till posted to C Troop at Aldershot, at the end of April, 1869. In 1869, he married Margaret, the eldest daughter of the Rev. J. J. Blunt, Lady Margaret Professor of Divinity at Cambridge. There were six sons by the marriage, the eldest of whom, after doing fine service under most trying conditions with the Telegraph Battalion, through all the troublous time on the Tugela in South Africa, died on his way home. Two others were all through the war with the K.R. Rifles, and the Artillery. The latter is now with the Riding Troop of the Royal Horse Artillery at Woolwich. Yet another served with credit in the Royal Navy, while another has, in the Indian Civil Service, held responsible offices under the Government of India. The youngest is now serving under the Egyptian Government.

Those of his friends who had the privilege of serving with Jelf at Aldershot, will always think of him as specially identified with the old Troops, and in the happy days of close friendships in the huts

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of the South Camp. A great friend, Lieut. (now Colonel) A. H. Bagnold, writes of the charm of his personality and friendship, and adds: "I think the principal characteristic of Jelf's life was, that he was a great enemy of any kind of strife. Wherever he was, it was no fault of his if there was not peace and sociability. He always strived for them, and worked hard and generally successfully to that end, and my impression is that wherever Jelf was quartered, there was peace, amiability and a good tone all round, due not only to his efforts, but also to his excellent example and natural influence." His friends were many both in the Corps, and outside it. It was at Aldershot that the friendship with Juliana Horatia Ewing grew close, a friendship which certainly coloured her books, one of which was dedicated "to the queer ones at Aldershot," the children of her devoted friends, the Jelfs.

In the end of April, 1873, he was gazetted Adjutant of the R.E. Train, an appointment which later on merged into the Adjutancy of the R.E. Troops and Companies.

A great friend of those days, Lieut. (now Colonel) C. F. C. Beresford, writes: "At that time Jelf and Mrs. Jelf were the centre of all social doings, and also of all the charitable and church work of the Royal Engineers at Aldershot. He was a delightful companion, full of intelligence and humour, and his great tact smoothed over many a difficulty. I often thought he would have made an admirable diplomatist."

Of his intensely happy home life of those days, it is not for us to speak, but it may be said that the glow and the interest of that charming home spread its influence far and wide.

In July, 1878, war with Russia was imminent, and a force was despatched to the Mediterranean. Jelf, who had been promoted Captain on the 17th April, was posted to the 31st (Field) Company, which was commanded by that good soldier, Major James Heriot Maitland (afterwards Major-General Sir J. H. Maitland, K.C.B.). The company, as a unit of the expeditionary force, was sent to Cyprus. Its interesting and useful sojourn there however entailed no active service, and the danger of war passed away. Jelf was struck down by a malignant fever, through which his brother officers nursed him successfully. He was sent on sick leave to England, and on the return of the company in March, 1879, he rejoined it at Shorncliffe, where he remained till May, 1880.

Being now due for foreign service, he was posted to Halifax, Nova Scotia, for two years, and then transferred to Gibraltar for a year. On the 24th of August, 1883, he was given command of his old troop (C Telegraph Troop) at Aldershot. Of this return to Aldershot, it is pleasant to think of the happiness to him and his. He threw himself heart and soul into the business of the Telegraphs, and into the raising of the Telegraph Battalion from the old C Troop, and the

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Telegraph Companies. Things were already moving in the direction of vastly improved organization, but still Generals of Division and Brigade had not learnt the vital importance of communications. Jelf did his utmost by word and action to push the cause of the Telegraphs forward. Colonel Beresford writing of the time when, later on, he took over the command from him of the 1st Division of the Telegraph Battalion, says: "I found it in thorough good working order, all ready for the development of our work in the field. In his farewell speech at a lecture in the Prince Consort's Library, Jelf complained bitterly of the neglect of the use of the Telegraphs in the Field by the Generals, and Sir Evelyn Wood, who was present, said that it would not be his fault if more work were not got out of them in the future. It was owing to the efficient state in which I found the 1st T.B., that I was able not only to work up to Jelf's demands, but greatly in excess of them."

Though he never saw actual fighting with the 1st T.B., Jelf had the great happiness of proceeding with it to South Africa, he himself on special duty as Director of Telegraphs, under Sir Charles Warren, with the Bechuanaland Field Force in November, 1884. The history of this thoroughly workmanlike expedition is well known, and how the Boers thought it better to leave the force severely alone, and to make terms. The year in South Africa was however full of incident and of strenuous work, and where all did well, none did better than the Director of Telegraphs and the excellent officers and organization he had under him. His subalterns of those days were devoted to their C.O., and never was there a happier lot of comrades than the bearded, corduroy'd officers and men of the T.B. on their return to Aldershot. It may be said here that of his subalterns of those days, three have already reached the Substantive Colonel's rank, one is a Brigadier-General. They have amongst them a C.B., a C.M.G., and three D.S.O.'s. Yet another is a Fellow of the Royal Society. His subalterns all speak of Jelf's wonderful power of getting the best work out of his officers in the best possible spirit. A better trainer of young officers never was there in the Corps. He had been promoted regimentally to Major's rank on the 22nd of June, 1885. For his excellent services with the Bechuanaland Field Force, he received an honourable mention, and was gazetted to a Brevet Lieutenant-Colonelcy on the 9th December, 1885.

He held the command of the 1st T.B. till October, 1889, when he was posted in relief to Portsmouth. There he remained till September, 1892, having been promoted Regimental Lieutenant-Colonel on the 27th July, 1892. He was now made C.R.E. at Gibraltar, and a period of fresh activity commenced. Amongst other interests, he put in strenuous work as Chairman of the Sanitary Commission from 1893 till 1897, leaving a mark in immensely improved sanitary conditions, which long survived his time. In

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acknowledgment of this good work at Gibraltar, he was gazetted a C.M.G. on the 22nd of June, 1897.

On the 27th of July, 1897, he was placed on half-pay, but only for a short time, for on the 3rd of September in the same year, he was gazetted Substantive Colonel, and appointed Colonel on the Staff, C.R.E. of the Eastern District. This appointment, his last on the Active List, he held till the 28th of February, 1901, being placed on the Retired List on the 1st of March.

He had only a brief rest in his home in Derbyshire, for in September of that year, he was recalled to serve as Governor and Commandant of the Royal Military Academy, with the temporary rank of Major-General. He held this office for three years, during which he was regarded on all sides as an excellent Governor. An old friend writes: "While he was Commandant at the shop, I paid him a visit, and could see how much he had done for the welfare of the cadets." Others of his friends had the good fortune to have sons at the Academy while he was there, and got to know the excellence of his discipline, coupled as ever with a courtly dignity and a warm-hearted kindness which endeared him and Mrs. Jelf to all the cadets.

It was a matter of regret to his friends that the rules of the Service did not permit of Jelf's receiving the honorary rank of major-general on relinquishing the appointment. It was a privilege he would have much valued.

On his final retirement, he at once took a lively interest in the Territorial movement, and on the resignation of the Duke of Devonshire, he succeeded to the Chairmanship of his County Association, a position he held till his death. His zeal, energy and enthusiasm kept up an excellent spirit in Derbyshire, and his services were invaluable. In every direction his assistance was freely given without stint. He was Honorary Colonel of the 4th North Howitzer Brigade of R.F.A., a magistrate, and Deputy-Lieutenant of the county.

In Ashbourne his influence was most especially felt. The local paper, from which much information has been derived, says of him that "The news of his death cast quite a gloom in the Ashbourne District, where Colonel Jelf was so highly esteemed, and universally respected. His life was so actively bound up with local institutions that it is well-nigh impossible to mention any which will not feel his loss. He was Vicar's Churchwarden, and in that capacity he applied most of his remarkable energies in supervising the restoration of the tower and spire of the Parish Church. He had a veneration for his Church, which one might well envy, and he did not mind how much he did on its behalf."

He was a Governor of the Ashbourne Queen Elizabeth's Grammar School, for which he had a strong affection, he was Chairman of the National Reserves, and Vice-Chairman of the Veterans' Association.

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He was active in politics all through his life, and was at the time of which we are speaking Chairman of the Ashbourne and District Unionist League. He was interested in numerous other local institutions. His name has been perpetuated in the local troop of Boy Scouts of which he was a strong supporter. A staunch upholder of the Church and Establishment, he was, however, wide in his sympathies, and his courtesy and kindness were given equally to all. He was in all his thoughts and interests so perfectly sane and purposeful, that he was a delightful and convincing speaker. He lived his life to the full, and he has left to the many who loved him the example of one who loyally tried to do his duty.

The funeral took place on Wednesday, the 30th April, at Ashbourne, with full military honours, the Territorial Field Artillery and the 5th Battalion Sherwood Foresters being present, whilst the pall-bearers were officers of "M" Battery, Royal Horse Artillery. Besides the family and personal friends, an immense concourse of people attended. The procession was over half a mile in length, and was most impressive.

The service in the church was fully choral, and was conducted by the Bishop of Southwell, assisted by five other clergy. In his address, the Bishop said "the life of Colonel Jelf has been a glorious life, the life of a good soldier of Jesus Christ. He had a noble sense of duty. He was zealous in his love for his country, and for the Army, love for his Church, love for his parish, love for the very building. He died with a great love for these things, which he had loved all through his life. To-day they had to thank God for His goodness, in teaching them the beautiful lesson of the resurrection, and for the noble example of the beautiful life of their brother, who had just gone to his rest."

A wonderful mass of floral tributes showed by the names of the senders and by the beauty of the inscriptions, how widely he had been loved and valued all through his life, and what a depth of affection and of respect he had inspired.

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TRANSCRIPT.

WAR SERVICE OF MILITARY AEROPLANES WITH THE BULGARIAN ARMY.

By S.A.B., in the April, 1913, number of *Injenerni Jurnal.*

THE following is a brief summary of a lecture delivered by Mons. S. S. Shchetinin, part-proprietor of the first Russian Aeronaut Company, who organized in Russia a special aviation detachment, and proceeded with it to join the Bulgarian Army in the Balkan Theatre of War. The two months spent there by the lecturer enabled him to form an estimate of its value. M. Shchetinin was requested by the members of one of the military societies in St. Petersburg to give a lecture on his experiences both in organizing and also in actual working of the aviation detachment, and this he did at a recent meeting of the society.

(1). THE AVIATION ESTABLISHMENT OF THE BULGARIAN ARMY AT THE OUTBREAK OF WAR.

When war was declared, the Bulgarian Army had one Blériot aeroplane and two airmen, Lieuts. Petrov and Terakchiev, who had been trained in Russia. In October, rapidly appreciating the importance of having an air fleet of their own, they purchased in Germany four Albatross biplanes, in France two biplanes (Voisin and Summers) and three Blériot monoplanes, and in England one Bristol biplane. In addition to this, the two young airmen were despatched to Russia with orders to purchase aeroplanes, and this they did, indiscriminately buying the first machines they found, without system and without consulting the cadre of trained airmen and instructors there existing. They procured a fairly large number of machines of various types, and a very limited number of airmen, including some officers who were only beginning to learn. The results soon proved very unfavourable for the Bulgarians. Three of the Albatross biplanes were wrecked at the very start of their practice in the aerodrome. Soon after, the Bristol was destroyed, and everything came to an end in a ghastly accident to Lieut. Toprakchiev, who was burnt to death in a fallen Blériot.

It seems that for a time this series of accidents so seriously affected the Bulgarians that they thought of giving up all idea of using an air fleet in the coming campaign, but they quickly recovered from the shock, and set to work upon the regeneration of their young aviation service, and in this regeneration Russia played an important part.

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(2). The Organization of the Russian Aviation Detachment and its Despatch to the Theatre of War.

At the beginning of the campaign a few Russian airmen, M.M. Efimov, Agafonov, and Lerche, had gone to the war as volunteers, and there the first-named carried out a number of flights over the fortress of Adrianople, where his machine was several times under fire, and through the insufficient height of his flights was pierced in several places. Aviator Agafonov made some trials with aeroplanes captured by the Bulgarians on the retirement of the Turkish Army, and on these aeroplanes he flew in the presence of ministers.

Aviator Lerche took with him two machines, one of which was lost on the way and the other was so damaged that it was impossible to use it. M. Efimov was therefore the only airman who carried out flights under war conditions. In these flights he threw down proclamations in the Turkish language, but his flights were rather demonstrations than actual reconnaissances, for the Bulgarians fully recognized that only an aviator, or more accurately an observer fully trained in tactics, can make full use of his opportunities.

The result of these attempts and experiments was that the Bulgarians came to a definite, though somewhat belated, decision to set about the training of *personnel* for an air fleet, and they proposed to M. Shchetinin that he should organize an aviation detachment as quickly as possible with a definite establishment of machines and pilot instructors, and should proceed with it to the seat of war, and there teach the required number of Bulgarian officers to carry out flights in the newly imported and existing aeroplanes.

It was required of him in addition that he should take absolutely everything necessary for all practical operations of the detachment, because in the region occupied by the Bulgarian Army it was impossible to obtain any aviation machinery or fittings.

The detachment formed by M. Shchetinin had the following establishment :—

Aviators :—Kostin (who came down in Adrianople and was made a prisoner by the Turks, an incident which called for a lengthy exchange of opinions between the representatives of the diplomatic world), Kolchin, Esiukov and Sielov. Besides these four aviators there were two mechanists and several unskilled labourers. Machines :—Four biplanes of Farman type N VII. (Gnome 50-H.P. engine), and for these there were taken in addition two motors, ten screws, and other spare parts.

For repairing the machines complete sets of all necessary tools were included, and for camp use waterproof hangar tents of the system designed by Lieut. Ulianin. The organization of the detachment was completed in five days and it was forthwith conveyed in a special train and by steamer on the Danube to its destination.

(3). Camp Experiences of the Detachment.

The camp of the detachment was pitched near Mustapha Pasha. The aeroplanes were housed in the hangar tents, while the men spent

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the night in the aeroplane cases, in spite of the weather being exceedingly cold.

The lecturer gave interesting details of the mobility of the hangar camp. At the time of one of the floods on the Maritza, when the river overflowed its banks and threatened to wash away the aviation camp, the tents were struck and the machines were moved to a distance of about 250 yards, and everything was re-erected, by night, in less than one hour. This campaign also showed that it is possible on emergency for an aviation detachment to bivouac in the open, and that the machines may be left without tents, it being necessary to cover only the motors and screws with tarpaulins. In this case it is also necessary to secure the aeroplanes from the action of the wind by means of pickets and ropes.

The lecturer emphasized the necessity of providing the men of aviation detachments with specially warm clothing, preferably of leather, as that only gives protection against damp. To protect them from cold is not difficult by means of furs and wool, but damp will penetrate all other clothing, and continuous leather costumes should be provided for both aviators and mechanists.

With a view to equipping a detachment with means of communication the lecturer considered it necessary that it should have motor cycles, as well as motor cars of a light design, to enable the mechanists to follow an aviator who has descended, and in case of damage to bring him the necessary tools, and possibly benzine.

A special medical panier is also in his opinion a necessary addition to the costume, or rather to the equipment, of aviator and observer, and should be carried on a strap like a knapsack.

(4). The Value of Aeroplanes at Lule Burgas, Chatalja and Adrianople.

Unfortunately the lecturer limited his remarks on the military use of aeroplanes to a few rapid sketches, applied to the various theatres of war, showing how aerial reconnaissance might have been effected. The writer considering that this part of the lecture was extremely important allowed himself to amplify it to some extent. It is impossible to pass in silence the operations of the III.Bulgarian Army (General Radko Dmitriev) at Lule Burgas, where the value of aeroplanes might have been of especially marked importance. On the 29th October, 1912, the Turkish Army (XVI., I. and II. Corps) was entrenched on the line Bunar Hissar-Lule Burgas. (More accurately, the XVI. Corps was at Bunar Hissar, on the left of it was the I. Corps, and further to the left, at Lule Burgas, the II. Corps. In rear of their left flank, near Chorla, was one Nizam division in reserve, and in rear of the right flank three divisions of the X. Corps, and, in rear again, the III. Corps). The length of front occupied was from 20 to 27 miles.

The problem of fixing the direction of the Bulgarian attacks depended entirely on the posting of the Turkish Army, but the III.Bulgarian Army when advancing to the attack could not, it appears, determine the Turkish flanks with sufficient accuracy. General Dmitriev at the

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commencement of the advance on 29th October supposed that the Turkish line extended only from Bunar Hissar to Karagach, whereas this last-named place was about the centre of the actual front Bunar-Lule Burgas, occupied by the Turks.

Thus in consequence of imperfect information as to the extent of the hostile position, and of inaccurate knowledge of its flanks, the Bulgarian Army had to waste the whole day in a reconnaissance in force, which entailed considerable loss. A probable task, which will in future be given to a modern air fleet, will be to define the flanks of positions occupied by the enemy, and to find out where his strong reserves are posted. In the present case the task could easily have been performed if there had been aeroplanes, but unfortunately there were not, and unnecessary loss of life was entailed by not making use of this modern means of reconnaissance.

Almost exactly the same thing occurred at Chatalja on the 17th—18th November, to which place the scene of action had then shifted, and the fighting, which ended unfavourably to the Bulgarians, again bore the character of reconnaissances in force. It resulted in the loss of two regimental commanders, in some parts of nearly all the officers and of a heavy percentage of rank and file. These reconnaissances in force would have been greatly facilitated by a judicious use of aeroplanes, especially as the Turks had no modern equipment for opposing them.

Turning to the use which was made of aeroplanes with the besieging army before Adrianople, one is obliged to admit that although it differed greatly from these other cases in quantity, yet in quality it fell far short of what might be called fully up-to-date aerial reconnaissance. The flights made by the civilian aviators over the fortress, resulting in the distribution of proclamations, could not be reckoned as active operations against the enemy, and yet in this case the Bulgarians could not act otherwise. Since the aviators were untrained in tactics, they were used in the only way which was possible.

It was unfortunate for the Bulgarians that they were not equipped with technically improved types of bombs, designed for dropping from aeroplanes, as this means of damaging the enemy should by no means be neglected, especially in the struggle for a fortress. The time is fully ripe for the organization of an instructional branch for teaching bomb-throwing from aeroplanes flying at a safe height (about 1,500 metres), and also for deciding upon suitable machines for discharging bombs. But this reproach directed by the lecturer against the Aviation Department, that they had not approached the question of bomb-throwing with sufficient energy, was rather ill-timed, as on the very day of the lecture there had been published the report of a committee which had considered the inventing and testing of machines for bomb-throwing from aeroplanes. In the operations before Adrianople, General Ivanov (commanding II. Army) recognizing the possibility of bombarding the central section (the town), made use of his aerial fleet as far as the fully appreciated defects of his bombs permitted.

The value of aeroplanes to a besieging army under present conditions requires no further explanation, but the Siege of Adrianople showed one interesting example of how great would have been the value of aero-

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planes to the defence. At a distance of about 15 miles from the city, near Mustapha Pasha, the Turks had left undemolished the only bridge in that neighbourhood over the Maritza. This bridge served as the only means of communication for bringing up the supplies of the II. Bulgarian Army. If the defenders of Adrianople had had aeroplanes they might not, possibly, have been able to demolish this bridge, but in any case they could have impeded its use and thereby have seriously harassed the Bulgarians, the more so as the Maritza so quickly and so frequently overflows its banks that the maintenance of pontoon bridges would have been extremely difficult.

Without mentioning the use which an air fleet might have served as a means of communication between the Turkish Armies at Chatalja and in Adrianople, this one application of it, that of cutting the communications of the besieging army, is so important that it may be taken as a rule that every modern fortress must be generously equipped with aeroplanes.

(5). ACTUAL EMPLOYMENT OF M. SHCHETININ'S AVIATION DETACHMENT.

At Adrianople one of the airmen of the detachment completed not less than 20 flights, but one of these flights, that of the Aviator Kostin, ended extremely unhappily, as not having oriented his position with sufficient accuracy at a considerable elevation, he descended in hostile territory. The chief object of the majority of these flights was the teaching of officers of the Bulgarian Army, who made flights with the Russians as instructors, the passengers learning piloting, observing, and bomb-throwing. The bombs were of very primitive design, the weight of each approximating to 10 kilograms. They were hung from the feet of the pilot, and were thrown " by eye," by a sharp jerk on the rope by which they were suspended, which released a slip knot.

On one occasion the aviators were directed to establish communication between the II.Army before Adrianople and the III.Army before Chatalja. The task was accomplished in two hours, and the lecturer was of opinion that by using the existing roads it would have taken about a week.

The flight was carried out in company with airmen of the Bulgarian Army, the aviators being Lieut. Petrov on a Blériot and the Russians Esiukov and Kolchin on Farmans. Of these M. Esiukov accomplished the distance of about 94 miles without a descent. The danger of such descents was very evident in view of the presence of bands of marauders in the intervening district.

After completing their flight the aeroplanes remained in the open, only the motors and screws being covered with tarpaulins. The absence of the mechanists impeded their further use, and these only arrived after a long delay.

The services of the airmen before Chatalja were limited to two or three trial flights, which had no practical results.

The armistice put a stop to a scheme, which was on the eve of being carried out, of making a demonstration flight over Constantinople, with bomb-throwing. The aerial bombardment of the hostile capital was therefore not effected.

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In conclusion the lecturer discussed the organization of a reserve of *personnel* for the air fleet, by making a timely and accurate registration of all non-military aviators, and directing that they should fulfil their military obligations in case of necessity in Aviation Sections. Individuals who on the declaration of war could do useful work in military aviation the lecturer would include in the special category of an aviation reserve or " Air Militia," as worthy successors of the Militia of 1812.

After he had completed the handing over of his detachment to the Bulgarians, and the training of several airmen in compliance with his agreement, M. Shchetinin journeyed from the seat of war to St. Petersburg where he shared with the public his interesting impressions and deductions.

F. E. G. SKEY.

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NOTICES OF MAGAZINES.

REVUE D'ARTILLERIE.

March, 1913.

PROGRAMME FOR ARTILLERY PRACTICE CAMPS.

A short article making suggestions for the best use of the limited time and ammunition generally available. It is not easy to evolve tactical schemes suitable to the narrow limits usually available for a range, these had better be left to war games and manœuvres. Coming into action and the disposition of the target on the ground should however be made as realistic as possible. For similar reasons groups and regiments cannot well be exercised together, and after all this training is more a question of organization of communications than anything else, and can be practised elsewhere without real fire. On ranges the battery will generally exercise by itself. All series of shots must be applications of the regulations, and limited to actual necessities, *i.e.* as soon as the correct range and fuze is determined fire should cease, and another exercise be commenced. Battery commanders should be given as free a hand as possible, but their chiefs also require practice, and should not leave all their control to the day of their inspection. Subalterns, and even N.C.O.'s, should be allowed to control the firing of a few rounds to accustom them to act in the next higher ranks in case of necessity.

THE INTRODUCTION OF A NEW FIELD ARTILLERY MATERIAL.

Lieut.-Colonel E. Lautereau du Part discusses the essentials to be borne in mind if modifications in the existing field artillery material were decided upon. He gives as the very first consideration the limits of weight imposed by the necessity for mobility across country, handiness when in action, and supply of ammunition. As the basis of his argument he takes the minimum weight practically realizable for the gun carriage and empty wagon. From this he argues out as first point, the maximum allowable weight for the projectile, and calculates to what extent alterations in the weight of the projectile affect mobility. This leads to a discussion of the diameters and lengths of the different projectiles practically worthy of consideration. The third point is the question of the stability of the gun carriage, the fourth the evaluation of the most suitable muzzle velocity. This leads to the consideration of the efficiency of the various projectiles in square metres of efficiently beaten area. The admissible solutions of the problem are then considered in terms

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of the power and efficiency of the piece. The directing principle in the choice of the best solution is stated to be that an increase in mobility, beyond what has in actual practice been found necessary, ought not to be obtained by a sensible sacrifice of power.

Contribution to the History of the Artillery.

The Responsibilities of the French Artillery in 1870 (*continued*).—The artillery has been accused of having no tactics in 1870, or of not putting them into practice if they had them, and of playing for their own hand, and not supporting their partners of the other arms in the struggle. The writer combats this accusation, and quotes numbers of cases where they sacrificed themselves in attempts to extricate others. Another accusation is that they frequently left the battlefield prematurely, but the Prussian artillery in 1866 behaved in the same way and they were not so severely criticized. The writer quotes the praises bestowed on the artillery by many generals and by M. Gambetta the Minister for War, and argues that the accusation is mainly an unjust one.

The New Japanese Mountain Gun.

Recent wars have shown the necessity for a gun that can accompany infantry over all country, cooperate with it closely during the attack, and assure the possession of captured localities. This gun is an attempt to meet that want. It has a screw breech mechanism, hydraulic buffer, and spring recuperator. The calibre is 75 m.m. The buffer and recuperator are enclosed in a cradle on which recoils a slide carrying the gun. The latter is in two parts, the barrel which is fixed by clamps to the slide, and the rear portion consisting of the breech and the slide. The cradle is fixed to the axle. Six horses are required for the transport of each gun and its ammunition, their loads being about 100 k.g. (220 lbs.). The article is illustrated by three photographs and a diagram.

Various Information.

Mention is made of the probable use of shells charged with thermite against ships of war. Thermite is a mixture of powdered aluminium and oxide of iron, and burns at such a temperature that iron or steel in contact with it is melted. A short description is given of the light steel bridge material carried by batteries of artillery in Austria-Hungary, enabling gaps up to 7·2 metres to be crossed in a few minutes.

April, 1913.

Universal Projectiles.

Common shell and shrapnel have each their separate functions, but sufficient of each can only be carried either by increasing the number of ammunition wagons, by using two guns, one with flat trajectory for shrapnel, and one with variable charges firing common shell, or by employing a shell half common, half shrapnel. The ideal shell should combine the best effects of each description of shell of the same weight. A quadruple action fuze is also required allowing of firing shrapnel with time fuze, or common shell with time, percussion, or the latter fuze with a delay action.

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Various shell invented up to date are described under the following headings:—

I. Projectiles with only one charge.

II. Projectiles with separate charges for the common and for the shrapnel portion.

(1) Charges in the base.
(2) ,, ,, centre.
(3) ,, ,, head.
(4) ,, divided.

Only I. and II. (1) and (2) are included in this number; the article is to be continued.

CONTRIBUTION TO THE HISTORY OF THE ARTILLERY.

The Responsibilities of the French Artillery in 1870.—The spirit of the offensive was inculcated, the defensive was hardly mentioned in regulations. The use of earthworks was decried, this led to rashness. The advantages to be gained by long range fire, possible with the rifled gun, was not recognized, the difficulties of observation being exaggerated. Too many guns were kept in reserve, and then were so badly employed by the higher commanders that they were either frittered away in small fractions, or were never brought into action at all. The Germans learned their lesson in the war in Bohemia, and were one campaign ahead of the French in experience. The writer considers that the blame for the failure of the French artillery in 1870 was on the whole not so much due to want of knowledge and training in the artillery itself, as to the incapabilities of the higher army authorities.

THE MULLER APPARATUS FOR LIMITING THE ANGLE OF FIRE OF RIFLES.

A full description of this apparatus is published, with various modifications introduced later, and is illustrated by two plates containing 17 figures.

VARIOUS INFORMATION.

Some data are supplied of the Italian 149-m.m. howitzer, and of the Norwegian 75-c.m. quick-firing mountain gun.

A.R.R.

REVUE MILITAIRE SUISSE.

April, 1913.

TACTICAL EXERCISES OF THE 9TH MOUNTAIN BRIGADE IN 1912.

The work for each day is described, but is difficult to follow without the necessary maps. It was the first year during which the new Alpine units were trained in the locality for which they are destined. Certain remarks are called for, and are given under the heads of mobilization, marches, bivouacs, signal services, distant and close reconnaissances, security, combat, food, and supply duties. The remarks all have reference to the special tasks to be undertaken by mountain troops.

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Concerning the Bill for the Reorganization of the Cavalry in France.

The Act of 1905 by which two years' service was introduced into the French Army was a specially severe blow to the cavalry, and this Bill, which was passed by the Chamber in two sittings, aims at the best possible organization and utilization of the meagre resources available.

Of the 89 cavalry regiments, 53, of which some are in Africa, are now distributed by brigades between the *corps d'armée*, and the remaining 36 are concentrated in eight groups as independent divisions. At the present day, however, the *corps d'armée* has practically ceased to exist as a separate unit; owing to the large forces congregated in a modern battlefield, the corps has become submerged in the army of several corps. It is the commander of the army who requires large bodies of cavalry under his orders, and this fact is evidenced in that during manœuvres all the corps cavalry are combined into so-called "provisional" divisions. These divisions have no staffs, no artillery nor machine guns, and no signallers. The object of the Bill is to give the required organization.

All cavalry opinion supports the contention of General Lacroix in the *Revue de Cavalerie*, that the division of six regiments (three brigades) is the most useful formation. He would make 10 divisions, giving to each a group of horse artillery, machine guns, a group of cyclists (three sections of 100 men), sapper cyclists, etc. There must be three types of divisions corresponding to the types of regiments in the service, the heavy division composed of two regiments cuirassiers and four regiments dragoons, the mixed division of two regiments cuirassiers, two regiments dragoons and two regiments light cavalry, and the light division of four regiments dragoons and two of light cavalry.

Omitting the cavalry in Africa, there remain 19 regiments of light cavalry which will be distributed to the Metropolitan *corps d'armée*, the two extra regiments required being brought home from Africa and replaced by Spahis. Each regiment of four squadrons will mobilize as six squadrons so as to leave, after deducting the divisional cavalry, a small force in the hands of the corps commander.

This organization of the corps cavalry is much criticized in the fear that the regiments will be so isolated as to deteriorate. To prevent this the appointment of an inspector-general of cavalry is suggested. Cavalry officers would like the latter to inspect the cavalry divisions also, as the army commanders would be strong and independent men, who might have their own ideas as to the training of cavalry, and there would be no uniformity in the cavalry of the various armies. A single authority would correct this.

Since the above was written three years' service has been reintroduced, and the Cavalry Bill has been passed by the Senate also. An inspector-general has been created to inspect all units of cavalry except in Africa.

The Question of N.C.O.'s in the Infantry.

In the February number Capt. Schmidt published an excellent article on this subject. His conclusion was that the N.C.O.'s lacked authority and initiation because

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(1). They are carelessly selected—each unit having to send a fixed number to the N.C.O.'s classes, irrespective of the number they considered properly qualified.

(2). The course at the N.C.O.'s School did not fulfil requirements.

(3). Many officers do not take the trouble to train their N.C.O.'s, nor to treat them properly. The officers do the work themselves as they cannot trust the N.C.O.'s, and N.C.O.'s are placed in the ranks and are frequently reprimanded before the whole company.

The present writer would add as another reason—viz. because they are N.C.O.'s of Militia.

To improve matters he suggests

(1). To allow more latitudes, and therefore greater care in the selection of N.C.O.'s.

(2). To modify the musketry course at the school, as suggested by Capt. Schmidt.

(3). A better utilization by the company officers of their N.C.O.'s during periods of training—they should be taken out of the ranks, given a short course of instruction early in the day, and then be given squads to drill and instruct, mistakes being corrected afterwards.

(4). To allow voluntary service of N.C.O.'s with recruit classes, where they would learn habits of smartness and authority that could not fail to be of use to their companies when they next train with them.

(5). To encourage zeal outside the Service, by encouraging N.C.O.'s Clubs, preparatory military courses, etc.

May, 1913.

THE BALKAN-TURCO WAR.

The mobilization in Bulgaria and in Turkey, and the operations in Thrace up to the Battle of Kirk Killisseh. The information given in this article is already so condensed that further abbreviation is hardly possible short of a complete translation.

THE MANŒUVRES AT PONT-DE-L'ARCHE.

Of historical interest, describing how, at the end of the 15th century, the Swiss were instructors in the art of war to practically the whole of Europe.

THE HOTCHKISS MACHINE GUN FOR AEROPLANES.

Gives a short description of this weapon and its mounting, accompanied by two excellent photographs.

THE MILLIÈME OF THE ARTILLERY.

Every artilleryman, except the English, now knows the millième, but few know that it was the invention of Capt. Ch. Dapples of the Swiss Artillery. The considerations which led to this method of stating the range are related. Shortly, it consists in graduating the back sight in thousandths parts of the line of sight.

BREAST HARNESS.

This harness proved a failure in the Swiss Army. The writer states what he considers to be the reasons for this, makes suggestions for overcoming it, and advocates the re-introduction of the harness.

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The Question of N.C.O.'s.

In order to meet the difficulty of obtaining good N.C.O.'s Colonel Monnier suggests reducing their number, giving them a better training in the recruits' schools, and so raising their prestige.

A.R.R.

Rivista di Artiglieria e Genio.

February, 1913.

A Roman Legionary.

This number contains a full and detailed description of the equipment and weapons of a Roman Legionary of the time of the legion instituted by the Emperor Marcus Aurelius, 42 to 31 B.C. The model of this soldier exhibited in the museum of Castel S. Angelo and constructed with great care by Professor Cav. Carlo Panati, Captain of Bersaglieri of the Reserve, shows not a common *mannikin* devoid of life and sentiment, but a sympathetic work of art which is well worthy of study and consideration. The legionary reproduced belonged to the Legion XII. with the title of *fulminatrix*, the soldiers of which legion carried on their shields as a symbol the *folgore di Giove tonante* (the lightning of Jove) with two expanded wings. The model represents a soldier probably of the 1st century wearing heavy armour, and a guard for the standards of the legion. The weapons used by the Romans were offensive and defensive, and the legionary represented has among the former the spear and the sword, and among the latter, the helmet, the cuirass, the shoulder pieces, and the shield. The clothing is shown in the tunic, trousers and sandals, and the sword belt. In rapid marches (*militibus expeditis*) the *impedimenta* were carried with the rear guard on wagons. The helmet or casque (*cassis*) has the front, back, and top (*apex*) of hammered iron all in one piece, the helmet strap of leather fastening under the chin, the red plume, and horsehair brush (*crista crinita*). The straps have iron buttons on one side with circular button-holes, as shown in the model of a Roman warrior in the courtyard of the Conservatory of the Campidoglio. The cuirass of iron (*loryca ferrea*) consists of five plates protecting the breast, and of plated shoulder pieces (*humeralia*). Under the cuirass the Roman soldier of that period is believed to have worn a kind of close corset of copper (*loryca de corio*) closed in front with copper buckles (*fibulæ*) which were very rich, and ornamented ; under the corset he wore a woollen tunic with short sleeves, and reaching to the middle of the thigh. Officers of noble birth also wore woollen trousers (*femoralia*) ; the tunic as well as the trousers were of various colours (white, red, blue, green) according to the legion. Round the neck the legionaries wore a woollen handkerchief, and we find a return to this custom in the handkerchief worn by the soldiers of modern Italy, led by Giuseppe Garibaldi. The shield (*scutum*) is of wood, convex, with iron edges, and ornamented with iron (*legionis tonantis signa*), copper sheathed, with the central part raised and plain in the form of a cup (*umbo*). As it is known, the hollow part of the umbo that was closed from the inside or outside of the shield with a kind of

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small door or opening contained the money for the soldier's pay, or other valuables. The shield was the sacred part of the armour and its loss was considered the greatest dishonour. The Roman sword (*gladius*) was short and strong like a large dagger. The hilt was of wood or black bone, 12 c.m. in length, with a slight curve for the fingers; a large and heavy pommel; and a two-edged blade (*cusis*) and a sharp point (*mucro anceps*). The average length of the sword was from the breast to the middle of the thigh, as described by Livy, and was worn on the right side in a manner that it was easy for the legionary to draw it rapidly with his right hand and thrust it *under* the adversary in hand-to-hand combats. The sword was enclosed in a scabbard (*vagina*) that had a cap with two rings and an iron point and was suspended from the left shoulder by a belt (*balteus*) ornamented with bronze buckles. The spear (*pilum*), not to be confounded with the javelin, was a strictly Roman weapon, and was formed of a shaft of wood (*hastile*) with an iron butt (*spiculum*) and a point (*cuspis*) partly of iron and partly of steel. Thrown against an enemy at a distance of about 8 or 10 metres, when it struck the target, the man was beaten to the earth by the point which yielded or broke off so that the spear could not be used against the thrower. After throwing the spear the legionary drew the sword with his right hand, and covered by his shield, attacked in hand-to-hand conflict. The soldiers wore around their loins a band of copper (*cingulum*) with ornamented bronze plates (*pendagli*): for the common soldier three, for trained men five, as shown on the bas-reliefs of the triumphal arches at Rome, where a standard bearer corresponding to a non-commissioned officer has five pendagli. The cingulum was an indication of honour, and soldiers sent to fight as a punishment did not wear this. The shoes or sandals were admirable, and even now deserving of imitation. The Roman soldier first wrapped his feet (leaving free the toes) in a band of white linen that reached to the ankle, fastened also with linen bands passing between one toe and the others. The shoe had a strong sole with iron nails (*solea et clavi ferrei*) fastened to the foot by a band passing between the great toe and the next. Many of the trained soldiers however had closed shoes like those in modern use.

* * *

The Roman Legion, properly so called, with its method of fighting in open order, dates from the first Gallic War, 226—224 B.C.; its best description is that of Polybius about 140 B.C. Other writers mention incidentally the legion and its tactics, but the following refers specially to that of the Imperial Epoch:—Under the first emperor and under the orders issued by Servius Tullius (about 550 B.C.) the Roman Army fought in masses like the Greek phalanx. The soldiers were distinguished in *classici or principes*, who constituted the 1st and the 2nd lines; *hastati* who formed the 3rd and 4th lines; *triarii* the 5th and 6th lines. There were also light troops called *veliti*, who fought in extended order around the legions, and auxiliary troops *proletarii* who did not form part of the legions properly so called. To these may be added the workmen—engineers, carpenters, smiths or *fabri ærarii*, musicians (*liticenes or tubicines, cornicenes, etc.*), servants and reserve men (*adecusi velati*).

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The *classici or principes* were selected from the citizens of more social and political importance, the classes decreasing in wealth or social importance followed, the *hastati*, the *triarii* and finally the *velati*. The *principes* were completely armed, with helmet, cuirass, round shield of bronze, called *clipeus*, sword, and a kind of pick. The *hastati* had wooden shields (*scutum*) and no cuirass, but armed like the preceding. The triarii were armed like the hastati but had no leg armour. The militia not of the legions had no defensive armour; they had picks and javelins and some slings only. From this phalanx originated the legion. The Republican Consuls for strategical and tactical purposes divided the phalanx into two, then into four, and again into more units, and finally rendered them lighter and better adapted for movements in Central and Southern Italy; and in the Gallic War we find the classical Roman legion composed of 30 tactical units (*manipoli*) organized in three lines. 1st line: 10 manipoli (each manipolo of 120 men) *hastati*. 2nd line: 10 manipoli (each manipolo of 120 men) *principes*. 3rd line: 10 manipoli (each manipolo of 60 men) *triarii*. To each manipolo there were added 40 *velites* who fought as skirmishers between the manipoli.

The manipoli were drawn up in ranks of 20 men each; each man occupied in the line about 3 ft. of space (and 6 ft. in open order); the distance between the manipoli was equal to their front, and the manipoli in rear corresponded to the space of the front ones. The arms during the Gallic War again underwent modifications. The helmet was increased in length (according to the Greek fashion), so as to defend the neck from the strokes of the long Gallic sword; the wooden shields were bordered with iron; the javelin was substituted for the *pilum*. Originally there were only four legions, but these increased in number so that at the time of Septimus Severus they amounted to XXX. (less the XVII., XVIII., and XIX. Legions—which were exterminated by Arminius at the Battle of Selva di Teutobergo and never reconstituted). The first four were held in special consideration and honour. Besides the infantry legions there were squadrons of cavalry. The Roman cavalry comprised a special class in the army (*classis equitum*) and remained under arms in peace times, while the legions were demobilized after each war. The cavalry in combat were placed on the flanks of the legions. The detachments of *socii* and *pretoriani* (Italian troops) and the *ausilarii* completed the ranks of the Roman Army. After the Punic War the Roman Army began to lose prestige. The Civil War between Marius and Sulla (about 88—82 B.C.), and internal revolutions, helped to increase the power of the more humble classes. Marius extended the right to bear arms even to the proletarii and the servi, and formed the cohort from the reunion of a manipolo of *hastati*, one of *principes*, and one of *triarii*, and this became the Roman tactical unit for the whole Empire. The legion was then composed of 10 cohorts, disposed originally in two lines at intervals; the *veliti* and the cavalry on the front and flanks, and also between the intervals of the cohorts. At the time of Julius Cæsar the cohorts were drawn up in three lines, and they were divided into hundreds commanded by centurions. The legions had for their standard a golden eagle, and were commanded by a *tribuno* or *legato*.

E. T. THACKERAY.

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RECENT PUBLICATIONS OF MILITARY INTEREST.

REVIEW OF BOOKS.

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FOREIGN ARMIES.

THE INFANTRY OF TO-MORROW. (L'infanterie de demain). By Monsieur Treignier. 301 pp. 8vo. Paris, 1912. Lavauzelle. 2s. 11d.

This book is a reproduction of the report made by Monsieur Treignier, in the name of the Army Committee of the French Chamber of Deputies, on the Bill for increasing the number of officers and N.C.O.'s on the cadres of infantry regiments. The Army Committee, in advising the Chamber to pass the Bill with some small modifications, points out that, as a reply to the large increases in her Army made by Germany, it is absolutely necessary for France to do something to render her military forces more formidable. An increase in the strength of the French Army is out of the question, owing to the declining birth rate and, therefore, the only way of improving the military forces of France is by making them more efficient. The Bill which forms the subject of Monsieur Treignier's report proposes to effect this improvement mainly by increasing the regimental cadres of officers and non-commissioned officers responsible for training Reservists in peace and leading them in war. It is pointed out that although the old idea was that, on the outbreak of war, reservists would be employed in garrisoning fortresses, guarding lines of communication, etc., it has now become imperatively necessary, in consequence of the decline in the French birth rate and the formidable increases in the German field armies, to employ the reserve troops of France in the first line, practically at the opening of the campaign. It is therefore of paramount importance to reduce to a minimum the period which the reserve formations require to settle down before taking the field and to keep up their efficiency during peace time. It is hoped to carry out these objects by increasing the cadres of officers and N.C.O.'s in the manner suggested by the Bill. It is not proposed to go into the details of the Bill because they are not likely to be of general interest, but the following points which are incidentally discussed in the report seem worthy of note :—

(1). The steady decline of the French birth rate is undoubtedly causing great alarm in France. The rate of this diminution may be judged from the fact that whereas in 1893, 343,651 youths reached the age for military service, in 1911 this number had dwindled down to 301,467 of whom 224,747 were passed as fit for service. It is calculated that if the same rate of decline and the same proportion of rejections are maintained there will only be 196,000 men incorporated in the contingent of 1927.

(2). In dealing with the organization of machine guns, the report remarks that in the majority of foreign armies they are organized as distinct units. In France, however, it is considered that they should form part of regiments and that machine gun detachments of various regiments should only be occasionally brought together for training and manœuvres. This arrangement is thought by the Army Committee to be a good one, not apparently for tactical reasons, but because it is thought that if machine gun detachments are made distinct and autonomous units the men are apt to become merely specialists in machine gun work and to know nothing of the

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duties of infantry soldiers. This, it is said, would probably be a serious thing on mobilization, because there would be far more specialist machine gunners than required and it would be necessary to put the surplus, who would be without a knowledge of infantry work, into the ranks of infantry battalions.

(3). The development of cyclists in France is of particular interest to the British Army. At the present time there are five cyclist companies attached to five battalions of *chasseurs à pied* on the North-Eastern Frontiers of France. The great utility of cyclists as a support to cavalry has been demonstrated by a number of experiments at French manœuvres. It is now proposed to raise 10 "groups" of cyclists. Each "group" will consist of about 300 men and will be divided into three sections. The question is discussed whether these cyclist groups should be permanently attached to cavalry divisions and the conclusion is that, as they will be required to do infantry work, they should be attached to infantry battalions and should train for certain periods in the year with cavalry divisions.

(4). The increasing use made by infantry of entrenchments in modern war is pointed out, and it is thought that in the battle of the future the engineers of a division will probably be incapable of dealing with all the engineer work which will be required. It is therefore proposed that each company of infantry shall have eight pioneers specially trained in engineer work.

(5). It is interesting to note that the report considers that a company cannot be efficiently trained in peace unless it consists of at least 100 men. It is therefore considered that, in view of the smallness of the French company in peace time, double companies should be organized for training purposes.

(6). It is thought that the captain of a company has too much administrative work to do at present, and that the fact is detrimental to the proper training of the company. It is therefore proposed to make a slight increase in the battalion staff and make the battalion commander responsible for much of the administrative work which now falls to the lot of the captain.

(7). At the present time there are some 5,700 societies in France which give gymnastic and musketry training to youths preparatory to their entering the Army. These societies issue certificates to those who reach a certain standard of efficiency, and the possession of these certificates carries with it certain very distinct advantages on entering the Army. With a view to trying to ensure that all men have had a certain amount of training in gymnastics and shooting before they join the Colours it is proposed to give further encouragement to the societies in question, whilst Regular officers are to be appointed to supervise their work and see that the instruction given is thoroughly up to date. It is hoped, moreover, that the societies may be utilized for the purpose of continuing the instruction of men after they leave the Colours.

HISTORY.

The Strategy of Frederick the Great in the Seven Years' War. (Die Strategie Friedrichs des Grossen im Siebenjährigen Kriege). By Major Schwertfeger, Professor at the Prussian Staff College. 24 pp., with map. 8vo. Berlin, 1913. Mittler.

This is a lecture given before the Berlin Military Society on January 24, 1913, the two hundred and first anniversary of Frederick II.'s birth, and, as the author reminded his audience, the fiftieth anniversary of the refusal of the representatives of the people in the Prussian Lower House to vote the supplies that William I. urgently required for Army reforms "in order to regain the Frederician power of offence (*Stosskraft*) that is the backbone of Prussian policy."

The lecture is a clever and useful summary of Frederick's methods. For thirteen years, 1745–56, the King made careful preparations for the war that he meant to undertake. He strengthened his Army, perfected its training, and made it a weapon of the first order. He did not wait until his opponents were prepared, but, relying on his greater readiness for war, struck first at the most favourable opportunity.

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He fully recognized that in war, as Napoleon so often said, he who attempts to cover everything covers nothing; temporary sacrifice of territory must be made for the good of the whole. To use his own words: "Small minds want to cover everything, intelligent people look only to what is vital (*Hauptsache*); they parry the heavy blows and put up with small misfortunes in order to escape great ones. He who seeks to cover all covers nothing. The essential thing, which one must never lose sight of, is the enemy's Army; one must guess his plans and oppose them with all one's might."

Frederick insisted on his officers studying their profession. "What use is experience if it is not ripened by study? It is reflection and capacity to array his ideas that distinguish man from a beast of burden. The mule that carried Prince Eugene's pack saddle in ten campaigns was none the better tactician for it. And shame is it that many men who have grown grey in an honourable service have made no better progress than the mule."

He gave particular warning that there is no book of the rules to success in war. "My methods were only good in consequence of the faults of my adversaries. They were slow; I was active. They, through indolence, failed to take advantage of opportunities; I seized every chance. My methods must not therefore be used as patterns. Stern necessity often compelled me to trust to chance. No rules can be deduced from the ways of a pilot who depends on the humour of the winds rather than on his compass."

THE BATTLE OF THE WILDERNESS. By Morris Schaff. 8vo. 345 pp. and 5 maps. Boston and New York, 1912. Houghton Mifflin Co. 8s. 4d.

The author, a West Pointer, and well-known as the writer of a charming book on his military school, *The Spirit of Old West Point*, served on General Warren's Staff in the Wilderness campaign. His book gives a general account of the fighting, with his impressions and reminiscences, and presents a most vivid picture of the fighting, the field of battle, and the troops. He has aimed at showing what an army in deadly combat is like rather than at writing military history.

After describing a service held by a Commanding Officer at 1 a.m. before the battle, he says: "Possibly the earnest student would prefer to be told the order of march and the exact distance they had to make; but I wonder which is the more enduring and significant fact—the young Colonel pouring out his heart to God under the starlight, or whether Blank's battalion moved first right or left in front?"

The first day's fighting showed Lieut. Schaff what was the matter with the Army of the Potomac. It had no power of initiative and no elasticity; and it was very careful of itself. "Its early commanders had dissipated war's best elixir by training it to a life of caution, and the evil of that schooling it had shown on more than one occasion and unmistakably that day." Besides caution, however, it suffered from panics; whole brigades bolted after barely confronting the enemy, and skulkers drifted back to the trains at the first opportunity.

As a staff officer he came in contact with most of the prominent Generals. He describes Grant as a "medium-sized, mild, unobtrusive, inconspicuously dressed, modest and naturally silent man. He had a low, gently vibrant voice, and steady, thoughtful, softly blue eyes. Not a hint of self-consciousness, impatience or restlessness, either of mind or body; on the contrary, the centre of persuasive quiet which seemed to be conveyed to everyone round him."

For Burnside he has the greatest contempt. Of him he says he "represented a well-recognized type in all Armies, handsome, ingratiating manners, and noted for a soldierly bearing—that is square shoulders, full breast, and the capacity on duty to wear a grim countenance, while off duty all smiles and a keen eye to please—who in times of peace, not only in our country but everywhere, invariably land in high places, and almost as invariably make utter failures when they are given commands on the breaking out of war."

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Of his own commander, Warren, who was one of his instructors at West Point, he says little, except that Grant neither liked nor trusted him, and that always serious, his seriousness deepened as he rose in fame and command.

The maps are excellent, and the book is thoroughly well worth reading both by soldier and civilian.

THE DIPLOMATIC ORIGIN OF THE WAR OF 1870–71. (Les origines diplomatiques de la guerre de 1870–71). Published by the French Ministry of Foreign Affairs. Vol. VI.* 491 pp. 8vo. Paris, 1912. Gustave Ficker. 6s. 3d.

This is the latest of a series of volumes containing a collection of official despatches which passed between the French Foreign Office and their ambassadors and ministers at Berlin, Vienna, Munich, Stuttgart, Stockholm, Dresden, Frankfort, Turin, Madrid, Hamburg, Hanover, Carlsruhe, Darmstadt and London, during the period March 1, 1865, to August 31, 1865. The volume will naturally be of value for purposes of reference, but will be of more interest to the diplomat than to the soldier. The long series of disputes and complications between Austria and Prussia regarding the question of the Duchies of Schleswig and Holstein which led up to the Convention of Gastein is described in great detail in the despatches contained in this volume. The probable attitude of France in the event of a rupture between Austria and Prussia is shown to have been a constant source of anxiety to Bismarck, and one is struck by the consummate skill with which that statesman endeavoured to obtain definite information on this point from Benedetti, the French Ambassador at Berlin. The latter in frequent conversations with Bismarck assured him that France fully recognized Germany's interests in the North Sea, and had no intention of interfering in the dispute regarding the Duchies, although she was most anxious that any arrangement made regarding them should be in accordance with the wishes of the people of Schleswig and Holstein. These assurances apparently did not quite satisfy Bismarck, who was afraid that France might have some idea of demanding compensation as the price of her neutrality in the event of an Austro-Prussian War. It would appear that, in order to obtain information on this point, he told Benedetti, in course of conversation, that he had heard from the German Ambassador in Paris that France had decided to assist Austria in the event of war with Prussia. This story seems to have been a pure invention, but the telling of it to Benedetti had the desired result. Benedetti, after denying that France had any intention of helping Austria, said: "I am authorized to ask you plainly what you wish us to do and what you offer us." According to Benedetti, Bismarck, on hearing this, was "obviously surprised," and, "after a moment's hesitation," replied: "What we ask of you is a benevolent neutrality both during our negotiations with Austria and afterwards, if they lead to war." Benedetti thereupon asked, "You have then no proposition to make?" To which Bismarck replied: "None at present." The skill with which Bismarck subsequently kept the French quiet is clearly brought out. The terms of the Convention of Gastein are given verbatim on pp. 463—466. The French Minister at Frankfort thus describes the results of this Convention: "It is the annexation, disguised, but none the less certain, of the Duchies of the Elbe by Prussia. The fate of Lauenburg is already decided; the rest is only a matter of time. Prussia had gained what she wanted." The French Chargé d'Affaires at Berlin writes on the same subject: "The question of money has evidently had a great deal to do with the recent success of the Berlin Cabinet; the state of Austria's finances has been a great help to Bismarck." The French Foreign Office view of the Convention is thus expressed in a circular letter to its representatives at the different European courts:

"Have the terms of former treaties been respected? Certainly not. The Treaties of Vienna have stipulated for the existence of the Danish Monarchy; the conditions

* Vol. I. of this work was reviewed in Recent Publications of Military Interest for November, 1910, and Vol. IV. in *The Army Review* for April, 1912, p. 617.

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of these treaties have been disregarded. The Treaty of London was a fresh proof of the solicitude of Europe for the continuance and integrity of the Monarchy: Austria and Prussia have torn up this treaty. Have Austria and Prussia consulted the interests of Germany? The members of the Germanic Confederation only learnt the terms of the Gastein Convention from the newspapers. Germany wanted a united Schleswig-Holstein, separated from Denmark and governed by a Prince whose candidature for the position of ruler they supported. The claims of this popular candidate have been set aside, and the Duchies, instead of being united, are now separated and placed under different rulers. Have the wishes of the people of the Duchies been consulted? In no way. On what principle does the united action of the Austrian and Prussians rest? We regret that we cannot see any principle but the application of force, or any justification for this Convention but the mutual convenience of Austria and Prussia."

MEDICAL.

THE HOUSE-FLY AS A DANGER TO HEALTH. By Ernest E. Austen. 11 pp., 7 illustrations. 8vo. London, 1913. Longmans, Green & Co. 1d.

This little pamphlet, printed by order of the Trustees of the British Museum, is written in popular language and well illustrated. Its object is to educate people in the life history of the fly, its potential danger to health, and how to get rid of it. Half an hour may very profitably be spent in looking through this publication.

MISCELLANEOUS.

THE SOLDIER'S FOOT AND THE MILITARY SHOE. By Major E. L. Munson, Medical Corps, United States Army. 147 pp., 54 illustrations. 8vo. Published by the United States Cavalry Association, Fort Leavenworth, 1912. 5s.

This book contains a summary of the investigations carried out by the Army Shoe Board during a period of more than four years. The purpose of the book is to supply practical information for the guidance of those officers who have to superintend the fitting of men's boots.

The chapter on the anatomy of the foot is written in simple language and well illustrated. The illustrations of footprints showing how the foot is expanded by carrying a load are most instructive and should be borne in mind when fitting boots. The radiographs on pp. 36 and 37 showing the bones of a naked foot bearing the weight of the body and the same foot compressed by a dress shoe should be studied before purchasing Mess Wellingtons. The requirements of a good military shoe are thoroughly discussed under twenty-six headings (pp. 43 to 55). The radiographs on pp. 60 to 63 showing the bones of the same soldier's foot encased in different shoes illustrate clearly the harm done by a faulty boot. The chapter on the fitting of military shoes contains much useful information and many practical hints.

The book fulfils the purpose for which it was written and is well worth careful reading by anyone who is responsible for fitting the soldier with boots.

SERVICE CHEMISTRY. By Lewes and Brame. 576 pp., with index. 8vo. London, 1913. Edward Arnold. 15s. net.

At no time in the world's history has the need for scientific knowledge been more important than at present, while the period available for acquiring it has, in the naval and military services, tended to contract rather than to expand.

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This book supplies a rational treatise on the more chemical side of the many subjects with which a large number of officers are so frequently brought into contact. The fact that a fourth edition is necessary shows that it supplies a want and has been appreciated by many. To keep it up to date, the present edition has had to be largely re-written; it includes a considerable amount of material not available in the ordinary text-books, a fact which adds to its value.

POLITICAL.

THE MEDITERRANEAN PROBLEM. (Le Problème Mediterranéen). By Charles Vellay. 85 pp. 8vo. Paris, 1913. Berger Levrault. 1s. 0½d.

This will be found an interesting little book by those who desire to read in a concise form the various aspects of a problem which is attracting so much attention at the present time. It is pointed out that Moroccan affairs, the War in Tripoli and the present Balkan War have added further importance to the Mediterranean question and have, in a way, made it the pivot of the foreign policy of the principal European Powers. Monsieur Vellay explains the different bearings of the problem as looked at from the point of view of Great Britain, Germany, Italy, Austria-Hungary, Russia and France and supports his statements by reference to official documents as to the public utterances of responsible statesmen. His conclusions regarding the general aspect of the Mediterranean question are as follows:—

"Regarded from a general point of view the Mediterranean question is becoming more and more complex and the great trade routes which are being opened up or are in course of development—as for example those from the Cape to Cairo, from Scutari (in Asia) to Bassorah, that also from Alexandria to Bassorah and Calcutta—are daily adding to its importance.

"If one looks to the root of the matter it will be found that the desire of the various nations of the world to control the trade routes passing through or near the Mediterranean is the essential point in a problem which is a vital one for each of the great nations of Europe. Those nations which do not obtain some of the spoils of victory in the great struggle which is now going on will be to some extent disarmed in the great economic battles of the future."

STRATEGY, TACTICS, AND TRAINING.

SUCCESS IN WAR—A SKETCH OF A DOCTRINE OF WAR. (Vaincre—Esquisse d'une Doctrine de la Guerre). By Lieut.-Colonel Montaigne. 3 vols. Vol. I., 253 pp., Vol. II., 253 pp., Vol. III., 157 pp. 8vo. Paris, 1913. Berger-Levrault. 13s. 4d.

This somewhat curious book has attracted a good deal of attention on the Continent. The main idea running through it is that war is a "moral science" and that mistakes committed in war are moral faults and as such should be punished. The author adds that "every defeat is a crime and everyone who is defeated is a criminal." Although the book is written in rather exaggerated language and is full of repetitions, and in spite of the fact that many of the author's ideas will not be generally accepted, there is some interesting reading in these volumes. The first volume is entitled "Preparation for the Study of War," and pp. 151 to 206, in which the writer deals with the subject of "Fear," are worth reading. The effect of fear on men and animals is discussed and various examples are quoted from the history of war to show the consequences of panic among soldiers. Colonel Montaigne then considers the measures to be taken to counteract the effects of fear, and he comes to the conclusion that the best means of instilling courage into soldiers is to make them physically fit, to teach them discipline, to fill them with patriotism and to place before them living examples of bravery in the shape of their leaders.

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The second volume is entitled "The Study of War." In pp. 9—163 the author discusses the various changes which have taken place in the armament of soldiers from the time of the pike up to the present day and the effect of the changes on warfare. He comes to the conclusion that in war the fighting spirit of the victors has had much more to do with their success than the question of armament, and he supports his contention by reference to the results of the Russo-Japanese War.

Then follows an explanation of the French doctrine of war. The views of Generals de Négrier and Langlois are discussed and then the modern battle, as viewed by the French Regulations, is described. After this the German doctrine of war is explained and the so-called French and German systems are compared. This volume concludes with a description of the Napoleonic doctrine of battle.

The third volume bears the title "War" and is the least interesting of the three. The author says "the demoralization of the enemy is the first aim of war and this is done by destroying him or terrifying him. The art of war may therefore be defined as the science of destruction and of terrifying." And he adds that in war "the man himself is the principal arm." According to Colonel Montaigne's view the "work of destruction" in a modern battle is done during the frontal attack, the "terrifying" of the enemy being accomplished chiefly by means of night surprises. The remainder of this volume consists mainly in a reiteration of the views expressed in the previous volumes as to the paramount necessity for preparing the man for war. Practically the only new matter introduced is in pp. 89—101 where the author energetically attacks the pacifist theory and warmly supports the views of Von Bernhardi as to the necessity for and value of war.

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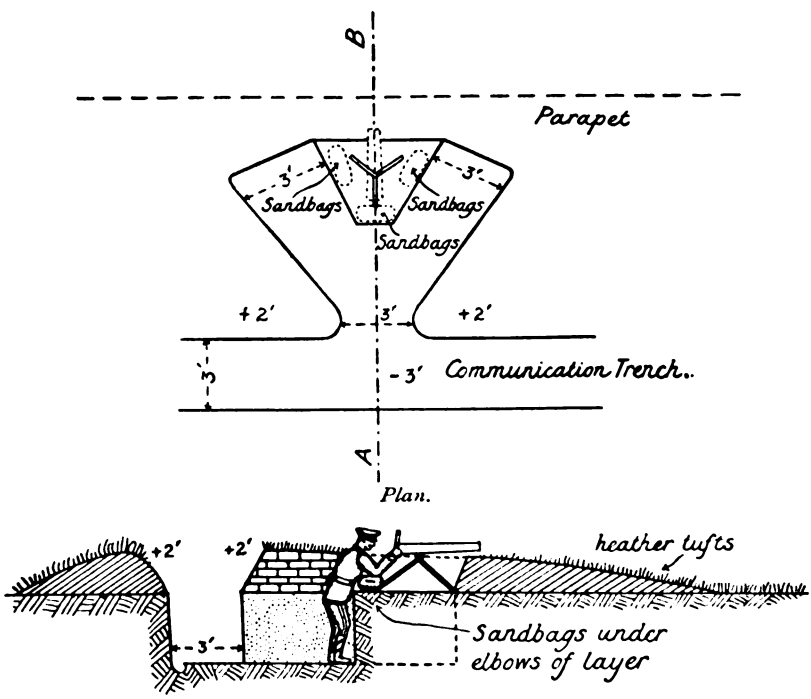
SOME NOTES ON FIELDWORKS.

By MAJOR R. N. HARVEY, D.S.O., R.E.

THE following notes have been compiled from the fieldwork reports of 1912—and will probably prove of interest. For facility of reference they have been divided into four subheads, viz. :—Field Defences, Bridging Expedients, Demolitions and Miscellaneous. Under the last of these are given the results of experiments in sapping, high wire entanglements, etc., as well as some new ideas for alarms and sap shields, and for the use of wire netting for various purposes in defence.

FIELD DEFENCES.

Machine Gun Emplacements.—It has been found that the sandbags supporting the overhead cover in the type of emplacement shown in the *M.F.E.*, 1911, *Plate* 15, *Figs.* 3 and 4, hamper the gun. If the pit is made with a smaller radius of 2 ft., the overhead cover may be supported from the flanks without intermediate support. This has been found satisfactory. Other types made under the direction of the infantry machine gun officers are illustrated in *Figs.* 1 and 2.



Section on AB.

FIG. 1.—*Machine-Gun Emplacement.*

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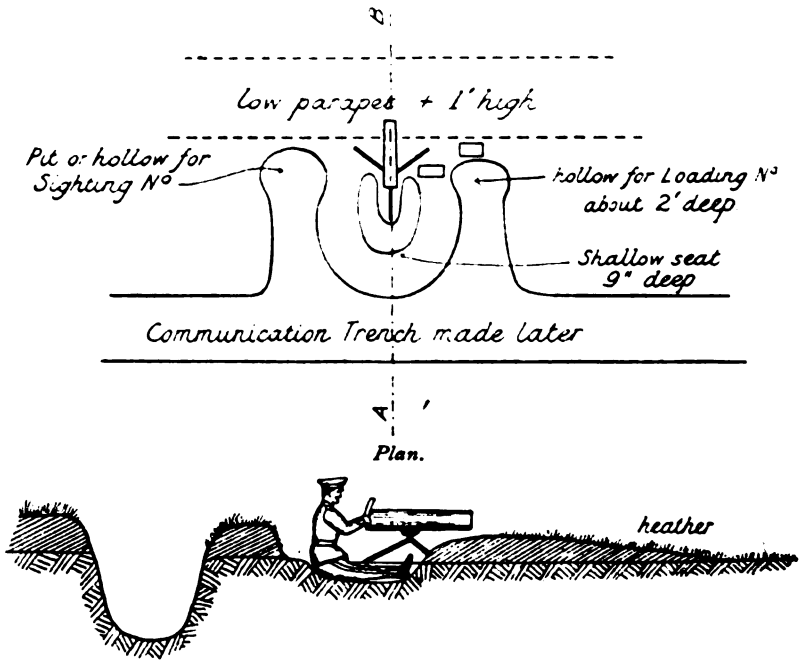
These emplacements depend for protection mostly on concealment, and if once discovered would soon be put out of action.

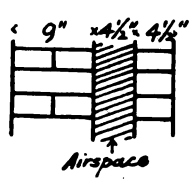


Section through AB.

FIG. 2.—*Machine-Gun Emplacement.*

Loopholes.—In brickwork it has been found that 3-in. external depth as shown in *M.F.E.*, 1911, *Plate* 10, *Fig.* 5, is not sufficient, but should be increased to 4½ in. so that the rifle may be used at ranges over 200 yards. Loopholes in walls of the upper storey of a house should have a depth of 6 in. externally.

Time taken by One Man in Making Loopholes in Walls.—(*a*). Through wall as shown in sketch. With company chisels and hammer, one hour.



(*b*). With mash hammer and 16-in. bricklayers' chisels, 23 minutes.

(*c*). Through 9-in. wall with crowbars, 27 minutes.

It is important to note the dimension 3 ft. 3 in. from front of overhead cover to cutting line of trench, and the dimension of 4 in. for height of opening. This latter dimension is certainly a minimum. It is of course important not to increase it unnecessarily, but in some situations 5 in. will be found necessary.

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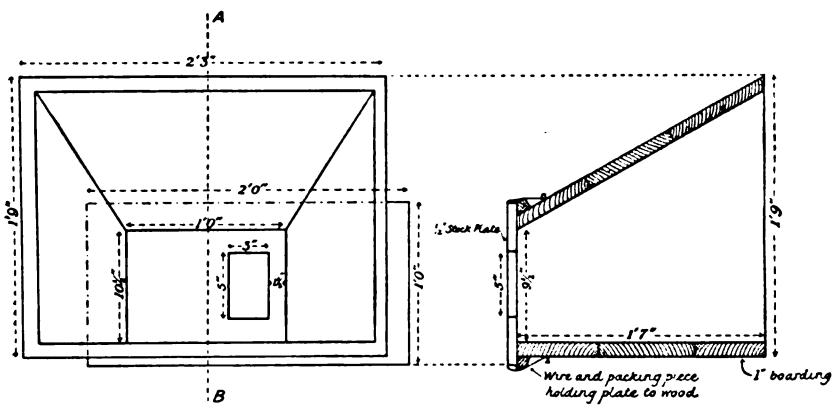
These two dimensions, breadth of head cover 3 ft. 3 in., and 4 in. or 5 in. loophole height, are interdependent; if the former is increased the latter must be increased also. The dimension 3 ft. 3 in. gives fair protection from a long range rifle bullet or shrapnel bullet entering the loophole and falling at 1/4, since, with a 5-in. loophole, a bullet just missing the top of loophole would strike the parapet a few inches in front of the man's hand, and would not reach his head or body. With this dimension (3 ft. 3 in.) it is essential to have the roof covered with hard material such as bricks or shingle, as the bullet would penetrate a foot of earth owing to the steepness of the slope. If earth only is available for the roof, then the dimension 3 ft. 3 in. must be increased to 5 ft. 3 in. and the 5-in. loophole to 8-in.

Two sheets of corrugated iron, 2 ft. 3 in. wide, will suffice for the roof when the dimension from the cutting line of trench to the front of head cover is 3 ft. 3 in., and three sheets will suffice when dimension is 5 ft. 3 in.

A box loophole combined with loophole plate as in *Fig.* 3, has been tried and is considered suitable for siege trenches. It can be placed on the parapet without undue exposure, be easily built round with sandbags, and forms a strong base on which to build a high parapet.



Front Elevation. *Sectional Elevation on AB.*

FIG. 3.—*Box Loophole.*

The device shown in *Fig.* 4 has been found successful for blinding loopholes. It consists of a hurdle covered with sods, pivots about its middle on forked sticks, and can be raised or lowered from inside by means of wires.

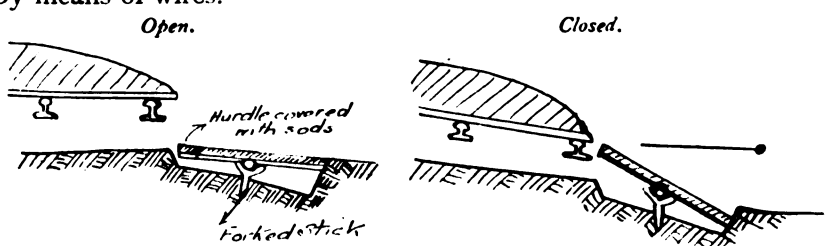


FIG. 4.—*Blindage for Continuous Slit Loophole.*

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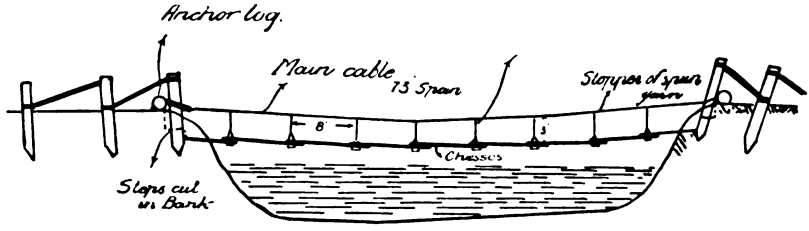
Clearing the Field of Fire for Works Inside and Near the Edge of a Wood.—A definite number of firing positions are selected in the trench, and tapes stretched from these in diverging lines to the edge of the wood. Between these tapes, all branches less than 3-in. diameter are then cut.

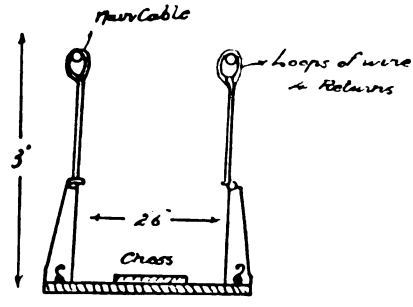
BRIDGING EXPEDIENTS.

Light Suspension Bridge to carry Infantry in Single File at 8-ft. Intervals.—Constructed out of Brennan wire and water-trough standards (*Figs.* 5 and 6).

Light Suspension Bridge of Trough Equipment.

FIG. 5.





End Elevation showing detail of standard used as slings.

FIG. 6.

Cables :—Five strands of Brennan wire twisted together.
Anchorages :—Anchor logs behind picket holdfasts.
Slings and transoms :—Trough standards and sills.
Roadway :—Bridging planks laid lengthways and lashed to sills.
Dip :—After loading with eight men in centre 30 in. per 20-ft. span.
Time.—Twelve men, one hour, stores being available on the spot.

Portable Suspension Bridge.—Constructed out of Brennan wire and gabion pickets (*Figs.* 7 and 8). Span 72 ft. Weight of bridge when rolled up, 200 lbs. Time to erect :—12 mins. 10 secs., the bridge being rolled up in wagon with all necessary stores.

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Brennan Wire Suspension Bridge.

FIG. 7.

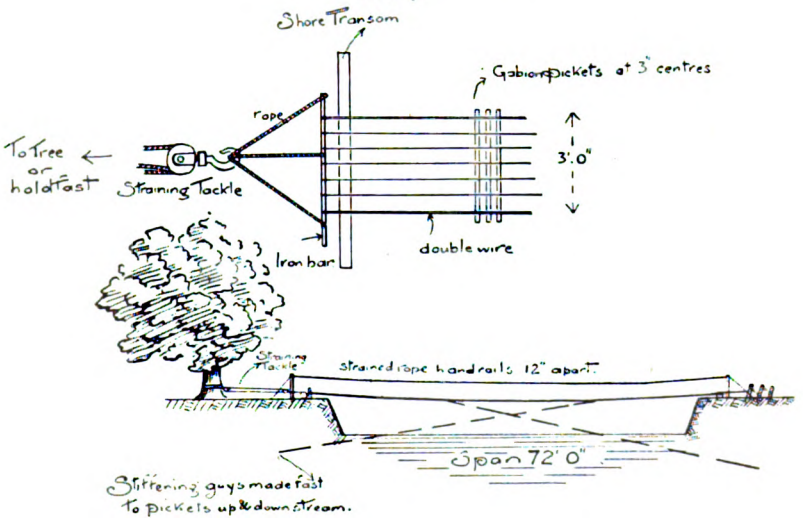

FIG. 8.

Light Bridge with Field Company Equipment.—Gap 85 ft. over water. Rate 8 mins. per 6-ft. bay.

Light Pile Bridge for Infantry in File.—Piles 4 in. by 4 in. Transoms 7 in. by 1½ in. Rate 15 mins. per 6-ft. bay.

Boat Made of Brushwood and Tarpaulin Wagon Cover, held four men sitting down (*Fig.* 9).

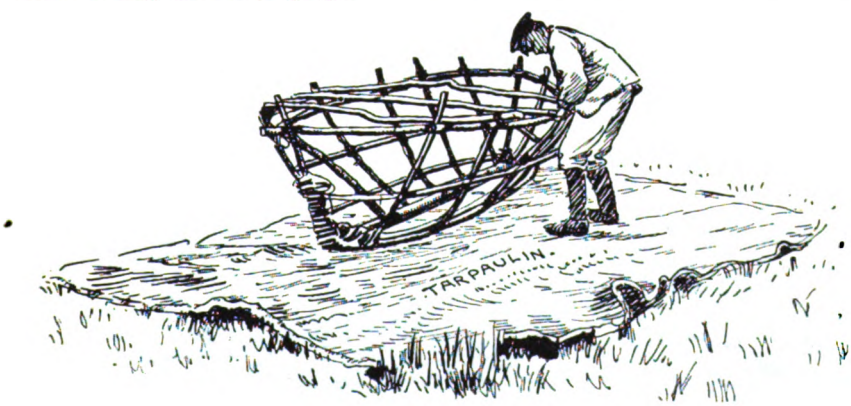

FIG. 9.

Boat Constructed Out of Trough Equipment (*Figs.* 10 and 11).—This boat can be made by four men in half an hour. It will hold nine men and with this load draws 4 in. of water.

Stores used:—Five trough standards, one trough, 12 sandbags, spun yarn, two spars 18 ft. by 3 in., four banneroles, four 1-in. lashings, five pick helves.

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Light Boat of Trough Equipment.

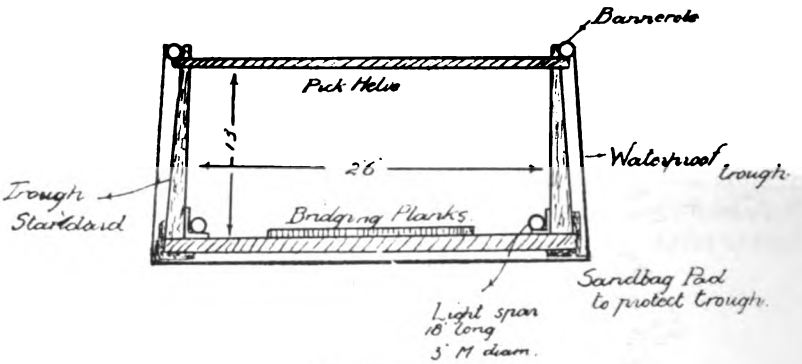

FIG. 10.—*Section.*

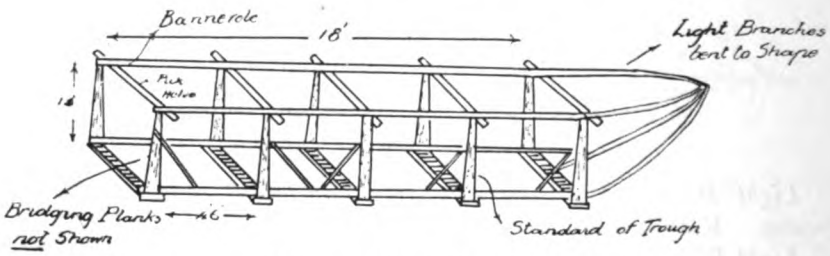

FIG. 11.—*Framework of Boat.*

Raft Made with Brushwood and Tarpaulin.—To hold 16 men (*Figs.* 12 and 13). In making the raft the tarpaulin is laid over a pit, 9 in. deep and the brushwood is placed across the pit, the lower layers with the butts in pit and the upper layers with the butts outside.

Brushwood and Tarpaulin Raft.

FIG. 12.

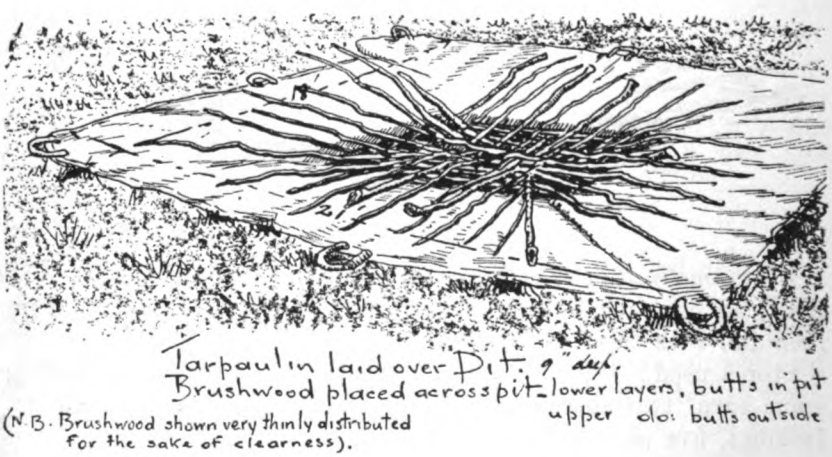
Tarpaulin laid over Pit 9" deep.
Brushwood placed across pit—lower layers, butts in pit
upper do: butts outside
(N.B. Brushwood shown very thinly distributed for the sake of clearness).

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FIG. 13.—*Raft afloat.*
The above raft held 16 men.

Getting a Line across a River.—An otter has been found to work only in an even current; thus in the Mohmand Expedition in 1908 across the Cabul River, a distance of 200 yards with maximum current of 6 miles an hour, an otter was got across successfully at the first attempt; but with the Abor Expeditionary Force, 1911–12, across the Dehang River which kept boiling up in eddies, it was impossible to get the otter across.

Signal rockets may be used for this purpose. The 1-lb. signal rocket fired at an angle of 45 degrees elevation will carry a tracing line across a gap of 100 yards. Great care must be taken to lay out the line directly behind the rocket and at right angles to the direction in which it is to travel, as shown in *Fig.* 14. As the back fire of the rocket may burn the end of the line a length of wire about 6 ft. long should be made first to the roof of the rocket and the stick and to this wire the line should be made fast.

The rocket and stick should be laid in a wooden trough.

Night Bridging.—A medium bridge, of two pontoons and two trestles was made in 1 hour 25 minutes. Trestles, ready made on either side of gap 84 ft. wide. Time taken 3 hours.

An Extemporized Catamaran Bridge for infantry in single file was made over a gap 160 ft. wide with level banks. With labour and material handy the time taken was 1½ hours.

Method of Launching Weldon Trestle.—Two trestles have been launched from a raft of two pontoons at the same time by launching one from a cantilever made of two ribands, and by upending the other on the baulks between the two pontoons and allowing the legs to drop. The transom of the latter trestle is then raised, the baulks taken out and the pontoons floated clear.

Improvised Capstan.—Two capstans have been improvised suc-

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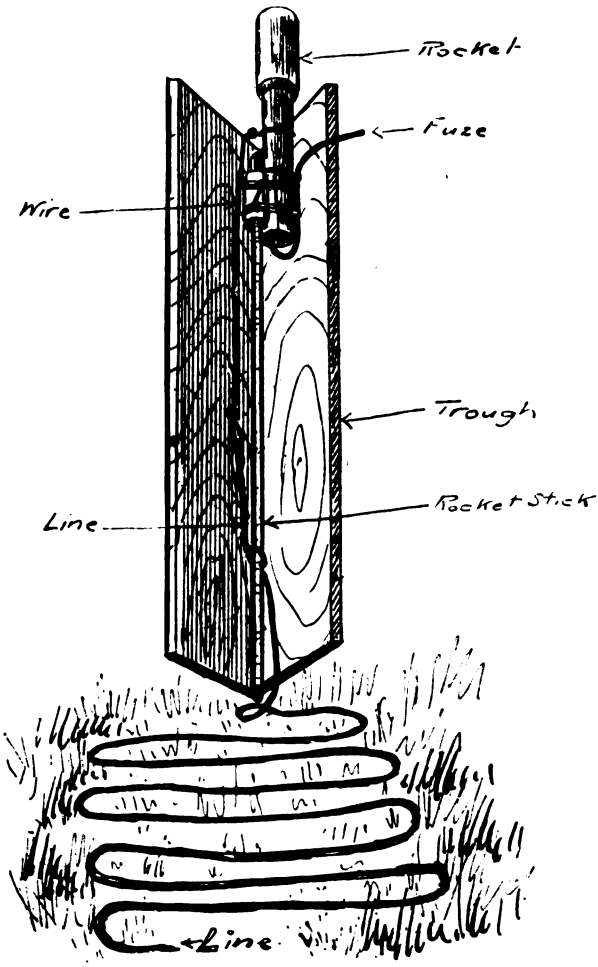

FIG. 14.

cessfully to work in connection with two swinging derricks, one with 1½-in. wire rope, the other with 3-in. hemp rope. They gave a power of approximately 24 to 1, two men with ease lifting three 15-ft. by 10-in. spars; the capstan winding the wire gear to the derrick was in continual use for a week without giving any trouble (*Fig.* 15).

Method of Tightening Main Cables of Suspension Bridges.—Fig. 16 shows a new method of fixing a block to the cable which has been tried and found successful.

Method of Making a Cable from Wire.—In order to lay up the rope evenly so that each strand will take its proper share of the strain, the selection of the number of wires is important.

Figs. 17 and 18 show, (1) that three strands of any gauge wire will lay up evenly, and (2) that six strands will lay evenly round a centre wire run straight. This latter 7-strand cable can be enlarged by adding successive layers of 12, 18, 24, and 30 wires making respectively 19-strand, 37-strand, 61-strand, and 91-strand cable.

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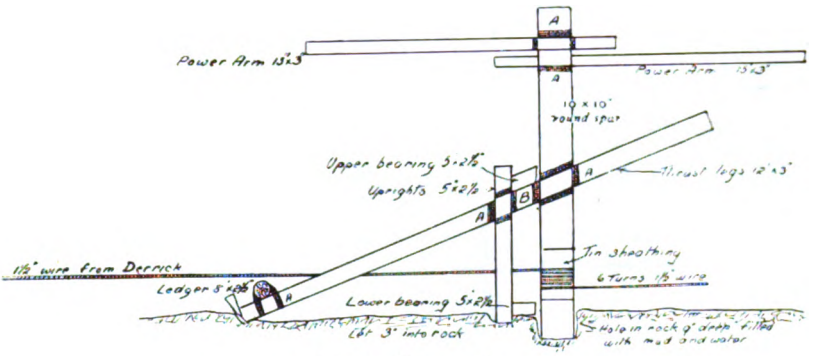
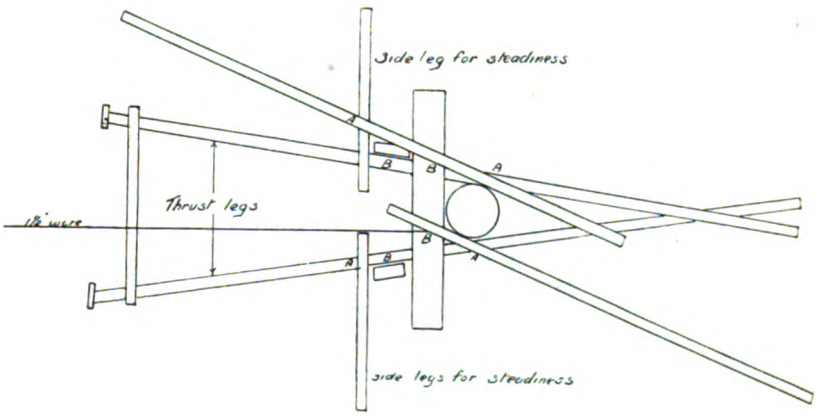


Rope lashings.....A
Wire ,, ...B

Elevation.



Plan.

FIG. 15.—*Improvised Capstan.*

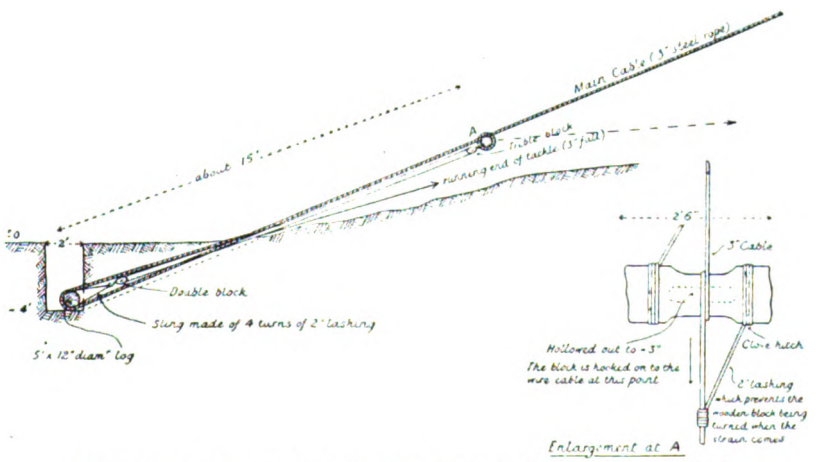

Main Cable (3" steel rope)
about 15'
Treble block
running end of tackle (3" rope)
2'
4'
Double block
Sling made of 4 turns of 2" lashing
5' x 12" diam" log
2'6"
3" Cable
Clove hitch
Hollowed out to 3"
The block is hooked on to the wire cable at this point
2" lashing
which prevents the wooden block being turned when the strain comes
Enlargement at A

FIG. 16.—*Arrangement of Tightening Main Cable when required.*

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Making Wire Rope in the Field.

FIG. 20.

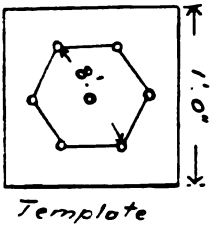
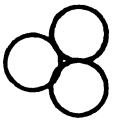


FIG. 17.



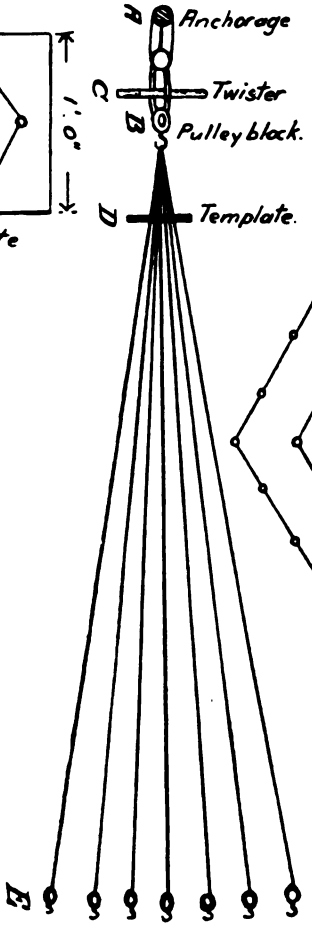


FIG. 19.

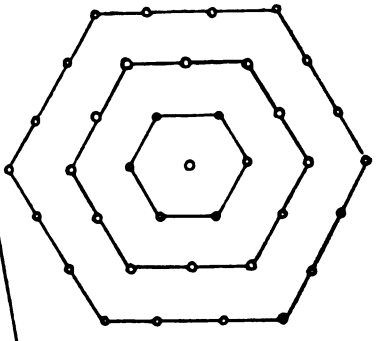


FIG. 21.

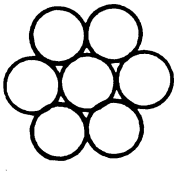


FIG. 18.

The following method of making the cable has given good results: An anchorage " A " is set up, and a pulley block " B " and a picket " C " 3 ft. or 4 ft. long is attached to it (*Fig.* 19). One end of each wire is attached to one of the small pulley blocks " E," and the other end is passed through the template D and made fast to the block B. The template D (*Fig.* 20) can readily be made out of a square foot of 1-in. wood, hard wood being preferable. The holes should be bored symmetrically in the shape of a hexagon, and on a circle of about 8-in. diameter, with one hole in the centre for the core wire. The pulley blocks E are each held by one man, who lays back on his wire to keep an even strain on it. The slackening of any wire during the process of twisting, will at once produce an uneven rope.

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The men should be from two to five paces apart according to the length of rope to be made.

Two men twist on the picket C, and two men hold the template at right angles to the centre wire, about 18 in. from where the wires come together. The swivels of the pulley blocks E should be well oiled so that the twist in each wire may be taken out, the men occasionally giving the blocks a turn to make certain that this is done. This is particularly necessary in the case of the centre wire.

By using alternate holes and omitting the centre hole, the same template can be used to lay up three wires together.

For a 19-strand or 27-strand cable a larger template must be used as shown in *Fig.* 21. The practical difficulty of finding enough pulley blocks or a big enough template will usually preclude the laying up of more than a 19-strand cable in one operation, and in this case the third layer may be put on separately. The same difficulty will usually limit the number of layers to three, but a larger cable can be made by laying up 3-strand or 7-strand cables instead of single wires. In this case, there is more waste of material, as in calculating the breaking strain on the finished cable, the centre core must be omitted. In larger cables, however, old hemp rope or some other material may be found for the centre core.

The following is a summary of the cables that can be made up:—

No. of Strands.	Method of Laying Up.	Breaking Strain. X = Breaking Strain of Single Strand.
3	Twisted together without centre core ..	3X
7	Six strands laid up round centre core	6X
19	18 strands laid up round centre core in two layers	18X
21	6 3-strand cables laid up round a centre 3-strand core	18X
37	18 strands laid up round a 19-strand cable ..	36X
49	6 7-strand laid round a 7-strand	42X
57	18 3-strand laid up round a centre 3-strand ..	54X
61	24 wires laid round a 37-strand	60X

Etc.

Demolitions.

Demolition of Two Old M.L. Guns (*Fig.* 22).—The charges could

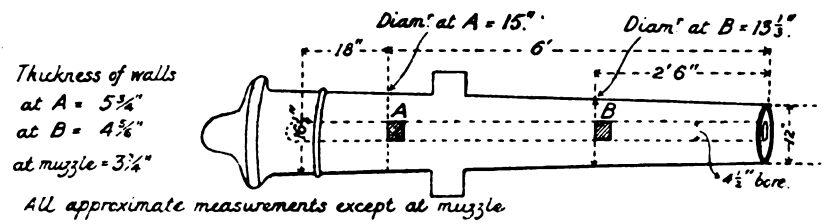

Fig. 22.—*Demolition of Two Old Muzzle-Loading Guns.*

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not be placed in the bore owing to obstructions in the bore which could not be cleared, and to the danger of using force to push down the charge.

Charges used :—

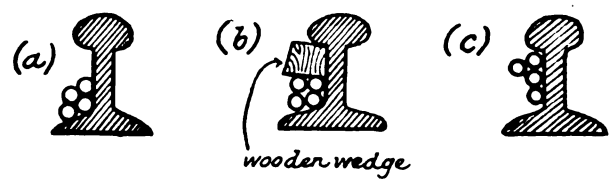
No. 1 Gun at A 1¾ lbs. wet G.C.
No. 2 Gun at B 2 lbs. dry G.C. (primers).

Results :—

No. 1 Gun. Blown into large pieces, which were not thrown far.
No. 2 Gun. Violent explosion, fragments thrown 300 yards in a direction at right angles to the axis of the gun.

Tree Felling.—A large fir tree has been felled in a given direction (to block a road) as follows:—Two side guys attached at right angles to line of fall. One back guy, about 6 ft. above base, loosely tied behind. Diameter of tree 23 in. Book charge, for soft wood, 12 oz. dynamite. Actually used, 14 oz. dynamite, in two 1-in. auger holes 18 in. deep connected by another hole at right angles. A slight pull on the foreguy brought the tree down in the required direction.

Rails.—Using charges as shown below for 60-lb. flat-footed rails laid in track on wooden sleepers, the following results have been obtained :—



12 in. of web and bottom flange cut. | 12 in. clear cut. | Clear cut, slightly better than in (*b*).

Charges in each case :—Four cartridges (8 ozs.) of dynamite.

(*d*). With 10 ozs. dynamite against the webs of the rails of an unfished joint—5 in. to 6 in. broken off each rail.

(*e*). With 1½ lbs. gun cotton against a complete fished-up joint—the two rails bent a maximum of 3 in. out of the line.

(*f*). With half a slab (¾ lbs.) gun cotton placed in *M.F.E.*, *Plate* 63—rail not cut.

With 40-lb. rails, 12 cuts have been made by charges of ⅛ slab of gun cotton, fired by 1-oz. dry primer, only one failure occurring where the top flange had not been cut.

Small Steel Girder.—The calculated charge being ¼ lb. gun cotton, four 1-oz. primers, placed as shown below, have been tried, the result was a failure, the web being only bent, and with one puncture in it, thus proving that the primers only acted along their line of contact.

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Steel Axle.—A 2-in. mild steel axle, having resisted several previous charges, has been broken by 1 lb. dynamite placed as in *Fig.* 23, to give maximum shear. This method has also been tried on a bolt rail, and though the shattering effect was spread over 2 ft., the rail was not so completely broken as when the charge was concentrated.

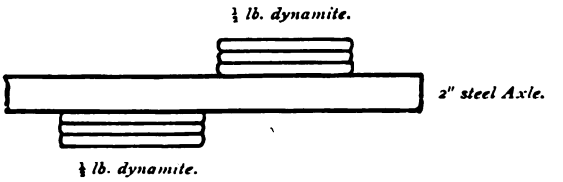

FIG. 23.

Masonry Piers.—To demolish thick masonry piers, both sides of which are open to attack, a great economy in gun cotton is effected by considering the pier half the thickness, applying the charge on both sides, and firing simultaneously. This has been found quite as effective as the usual and more costly method.

Letting off Mines under Trains.—The following methods have been tried of automatically letting off mines under trains :—

1. A No. 8 Detonator, placed on the rail or protruding vertically at a joint ; this usually fails under slowly moving trains.
2. A commercial cap gave a similar result.
3. Six non-safety match heads inserted in the split end of instantaneous fuze, enclosed in small waterproof covering and laid on the rails. This was found to be the best mechanical method, 70 per cent. of the tests being successful.
4. Electrical as shown in *Fig.* 24, the contact being made by the deflection of the rail, and being adjustable so as to admit the passage of a trolley, but not of a train.

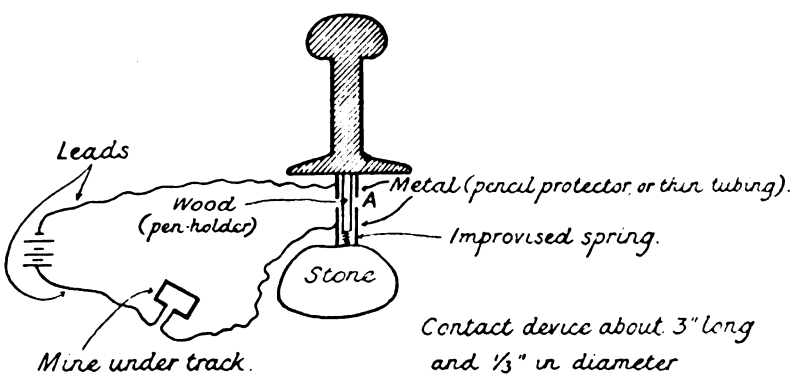

FIG. 24.—*Electric Contact Mine under Train.*

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Austrian Fuze.—This has been found to work well with a commercial cap, but cannot be used with a No. 8, Mark IV., Detonator.

Failure of Two G.C. Primers to Detonate.—The cause of this failure has not been ascertained. All the other primers in the tin detonated properly. Both primers were blown to pieces by the detonator, and in one case the charge as well, but in the other it remained whole.

Failure of Gunpowder Demolition.—To demolish a masonry wall, eight charges of 12½ lbs. of gunpowder each were connected up in series and fired electrically. The charges were at 3-ft. intervals and tamped. Two only of the eight charges exploded, and these two had their *electric fuzes still intact* though the heat had burnt the paint off them. All the fuzes were dug up and tested for continuity, and did not show any signs of disconnection, and they were afterwards fired successfully. One fuze was found with the leads touching, thus short-circuiting that charge but this does not account for the failure of the whole circuit. No reason has been found for this or for the explosion of the two charges, which left their fuzes intact.

MISCELLANEOUS.

Sapping.—The difficulty of removing earth from a deep sap about 50 yards in wheelbarrows in wet soil has been overcome by converting the wheelbarrows into handbarrows as follows:—

The top of the barrow is taken off, and slings are attached with loops projecting over the sides. The earth is pitched direct into the barrows at the sap head, and two bamboos are placed through the loops for carrying purposes. Handbarrows can thus pass one another in the sap where wheelbarrows cannot do so.

Rates of work:—

Deep sap with wheelbarrows 5 ft. in 4 hours.
With handbarrows 6 ft. in 3½ hours.
Shallow sap 4 ft. in 1 hour.

Drainage of Saps.—To facilitate the drainage of a sap which continually filled with water, sumps, as shown in *Fig.* 25, have been constructed out of two branch gallery mining cases, and the water pumped out of these periodically.

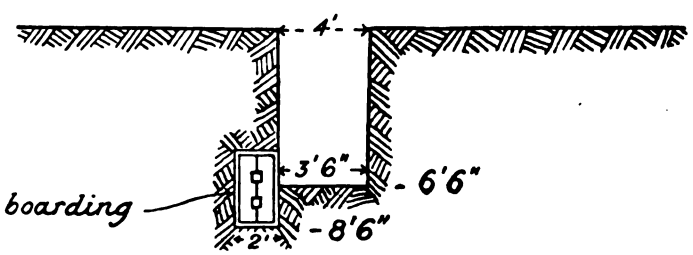

FIG. 25.—*Cross Section of Sap showing Sump.*

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Trip Wires and Alarms.—*Fig.* 26 shows a type of electric alarm which has been found successful. A bell and battery are taken from a house and connected as shown ; the bell placed in the defender's trench being muffled so that the enemy will not know when the alarm is given. It is a simple alarm, not easily discovered, and acts when any of the wires in the fence are either pulled or cut. *Fig.* 27 shows another type of alarm which has been found successful.

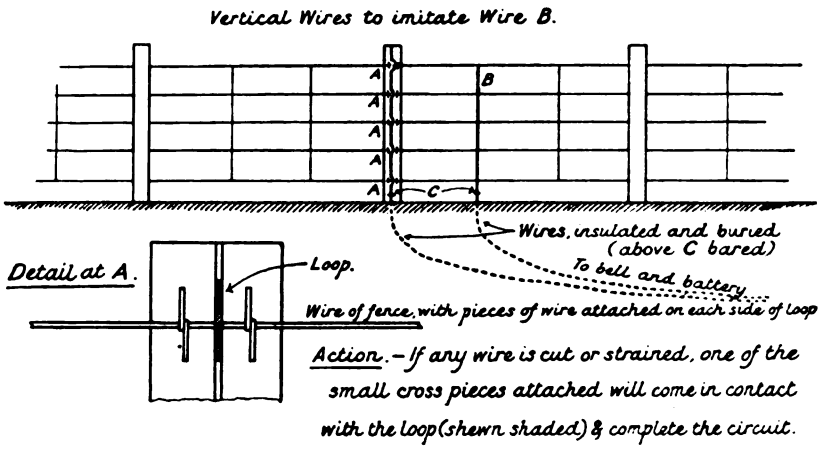
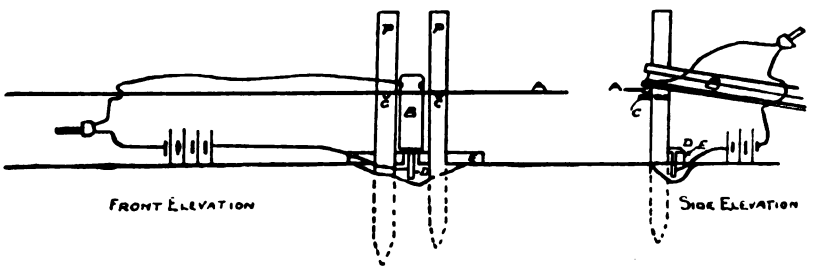

Vertical Wires to imitate Wire B.
A
A
A
A
A
B
C
Wires, insulated and buried (above C bared)
To bell and battery
Detail at A.
Loop.
Wire of fence, with pieces of wire attached on each side of loop
Action.—If any wire is cut or strained, one of the small cross pieces attached will come in contact with the loop (shewn shaded) & complete the circuit.

FIG. 26.—*Electric Alarm.*



A. Trip wire stretched between two posts not shown.

B. Rail resting on A held up on two pins C (made of short lengths of wire) driven into posts P, which act as guides.

D. Spike resting on a block of wood E bored to allow the shank to pass through.

Action.—If the wire is *cut*, B is allowed to fall and strike D, thus completing the electrical circuit. If the wire is kicked it falls off the pins C and allows the end of B to clear the trip wire, and so to fall.

FIG. 27.

High Wire Entanglement.—Stout posts 6 in. in diameter, have been driven by four men working on a hand monkey weighing 100 lbs. (*Fig.* 28). Two men hold the crowbar, which is let into the first

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9 in., in position with ropes; and the other two lift the monkey, standing on two light 4-legged trestles to do so. A few turns of wire are put round the top of the posts to prevent them splitting. Time in ordinary soil about five minutes.

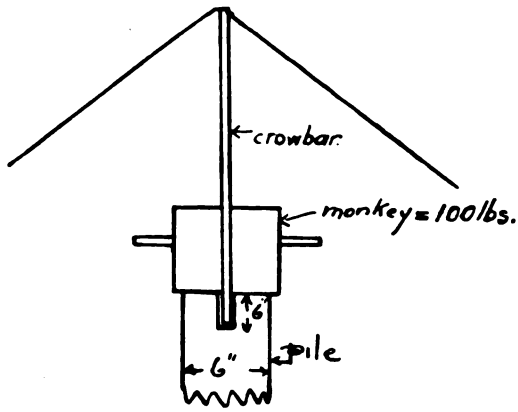

FIG. 28.

Reaching an Obstacle under Cover, or concealed from the defenders. The following methods have been tried. A man covered with bushes and heather tied on to him was able to crawl very slowly to some abatis without being noticed by the defenders. He could then have fired the abatis. A shield as shown in *Figs.* 29 and 30, which can be passed up to the advance trench, and put together there, was pushed out from the trench by a sapper up to the obstacle. One criticism against this is that the wheels might be shot away by rifle bullets, and the shield collapse before the obstacle is reached.

Experiment in Demolishing a House.—The building in question was a very old wooden hut of the ordinary type, single storey, wood floor, and clap-boarding sides, built on brick footings. The roof was wood covered with tarred felt. The timber was cleared about 100 yards from site. The cube of building was about 36,000 cubic feet.

Time and labour=900 man-hours. Rate 40 cubic feet per man-hour.

Visibility of Troops Digging in Dry Soil.—The presence of troops digging in dry soil has been given away at distances from 2 to 5 miles by dust from shovelfuls of earth falling upon the parapet. At night, sparks in stony ground were very visible.

Making Communications inside Buildings.—Using two hammers, three men were able to break an aperture of 2 ft. 6 in. by 2 ft. 6 in. through a 9-in. wall in 45 minutes.

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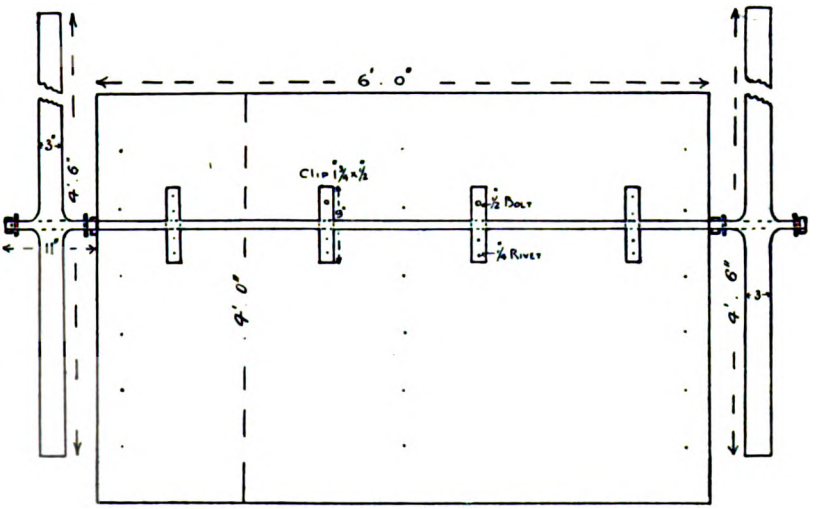
Sap Shield.

FIG. 29.



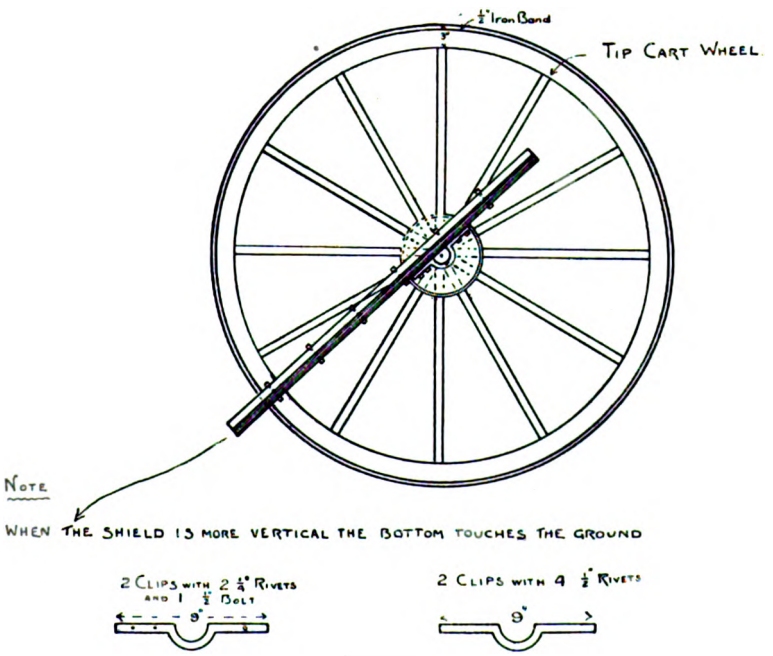

½" Iron Band
Tip Cart Wheel
Note
When the shield is more vertical the bottom touches the ground
2 Clips with 2 ¼" Rivets and 1 ½" Bolt
9"
2 Clips with 4 ½" Rivets
9"

FIG. 30.

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Use of Wire Netting.—Wire netting of 1-in. mesh, 3 ft. wide, and weighing 21 lbs. per 50 yards, has been used for the following purposes:—

(*a*). As a screen for guns, etc., to conceal them from view from an aeroplane.

(*b*). As a screen to conceal the movement of troops from an enemy's view.

(NOTE.—In each of the above cases furze or other material was twisted into the meshes of the netting, the materials varying with the background).

(*c*). As a revetment for earth.

(*d*). As a fence to keep animals away from sources of water supply.

(*e*). As an obstacle.

(*f*). In sheets 6 ft. long as ways for crossing wire entanglements; described in Part I., *Field Defences.*

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AERIAL RECONNAISSANCE, ITS POSSIBLE EFFECT ON STRATEGY AND TACTICS.

(*Extracts from a Lecture given by* CAPT. W. A. DE C. KING, R.E., *at Devonport on 23rd January*, 1913).

AERIAL Reconnaissance may be either strategical or tactical, and it is proposed in the following notes to consider it principally under these two heads.

Turning first to Strategical Reconnaissance it is evident that the work should be carried out either by powerful dirigibles or by aeroplanes carrying guns for protection. When a long over-sea journey has to be made a dirigible would seem to be absolutely necessary as it can take advantage of favourable winds and wireless telegraphy will enable the information to be sent back, so that a speedy return is not essential. When both forces are close to one another, it may be preferable to use an aeroplane. For a medium journey, the question as to whether an aeroplane or an airship should be used will be settled when wireless is installed in the aeroplane; at present the aeroplane has to return in order to deliver its message, whilst the dirigible can send it back by wireless, and this is naturally a very important consideration. The value of information obtained depends upon the rapidity with which it can be delivered.

Tactical Reconnaissance on the other hand may be carried out either with airships, aeroplanes, captive balloons or kites.

Aircraft can carry out protective reconnaissance, and it would appear that, when the forces are not in contact, an aerial reconnaissance carried out before nightfall will be of incalculable service to a force on the march. At night, however, cavalry cannot be superseded, and this arm must be used when the forces are in contact. Captive balloons and kites, in the absence of aeroplanes, could be used with an advanced guard.

The question of the service of intercommunication is a very important one, and it must be remembered that there may be a lack of telephone or telegraph lines, wireless messages may be blurred by interference, and existing lines may be damaged.

A single-seated aeroplane of the swiftest type would evidently be most suitable for such work, but it must concentrate its attention on speed and cannot afford to fight. In the Russo-Japanese War, at the Battle of the Yalu, the failure to let the Russian commander

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know the state of affairs on his left flank, viz. of the retreat in a wrong direction, contributed to his defeat. Messages were sent, but in one case the messenger was drowned and in the other the message was delivered $3\frac{3}{4}$ hours after its despatch.

Aerial reconnaissance can also be of great use for topographical work.

Although it appears to be a popular idea that an observer in an aeroplane or airship can see every thing for miles round, this is only possible in very open country. In England troops can easily be screened by hedges, etc., and it is evident therefore that, in a straight flight between two points, an observer cannot discover troops at any great distance on his flanks. This means that it is almost necessary to reconnoitre every main road, and one observer cannot possibly be expected to scour a large area in a short time.

Observers should always be given very definite orders and should be familiar with the different march formations, vehicles, guns, etc. There is consequently no limit to their technical and tactical preparation. An observer, to be of real use, must have plenty of practice in reconnoitring from aircraft, and, at a good height, a novice will take some time to find his bearings, etc. One way of practising such reconnoitring is by observation from free balloons as it is thus possible to get long runs at high altitudes.

As compared with the other arms the use to which aerial reconnaissance may be put is as follows :—

Cavalry.—It is accepted that it would be possible to carry out in about four hours an aerial reconnaissance which would take officers' patrols, sent out from the strategic cavalry, at least three days, while the prospect of acquiring the information by the patrols would be less. A popular idea is that aerial reconnaissance will do away with the necessity for the employment of cavalry in reconnaissance, but this is of course an entirely mistaken one. Various reasons have been put forward why cavalry cannot be replaced by aircraft for reconnaissance work ; for instance the impossibility of flying in very bad weather, or of seeing in foggy weather or at night. But without doubt this arm may possibly be relieved to some extent of the duty of providing for long distance patrols.

Surprise in war is a great factor; to lead an enemy to believe that there are troops where none exist, or *vice versâ*, is to gain an advantage. Aerial reconnaissance will render this surprise very problematical and bluff will no longer be possible or at least much more difficult. In the Russo-Japanese War the Japanese screened their movements with a force of all three arms and the Russian cavalry were unable to penetrate this screen. It is likely therefore that this method will be adopted in the future.

To obtain reliable information cavalry must fight ; to screen a large force it must be spread over a large front, which means con-

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centration on the one hand and dispersion on the other. It also keeps touch with the enemy by day and night, but it has less chance of finding the enemy's masses.

It is laid down in *Cavalry Training*, 1912, that it will depend mainly upon the general situation and the strategical object in view, whether the greater part of the cavalry is employed in the first instance upon protective or other duties, and that, if the first consideration is to obtain accurate information, the commander will usually send forward as strong a body of cavalry as possible for reconnaissance. On the other hand, if the first consideration is to cover one's movements, the greater part of the force will be employed on protective duty. Surely by means of aeroplanes it will be possible to economize as regards protection and reconnaissance, and so increase the strength of the independent cavalry.

Artillery.—The question of aerial reconnaissance in connection with artillery is a most important one.

It will be necessary to attack aircraft from the ground as well as from the air, and the units of an aerial fleet should be armed so as to take the offensive; in fact there should be "destroyers" and "scouts." It is considered by some that it will be impossible to hit an aeroplane travelling at a high speed, but the experience gained in Tripoli and the Balkans seems to prove the contrary. An aviator at Adrianople stated that once, when at an altitude of over 4,000 ft., he was fired at, the shell passed above him and burst, but, owing to the speed the machine was travelling, he cleared the fragments; the trail of the gun had been sunk in a pit.

Constantin was shot whilst making a flight before the Chatalja lines, and was found dead beside his machine. The wings of the biplane had also been hit, although the barograph registered 3,965 ft.

Petroff is reported to have stated that he had been flying regularly twice a day over Adrianople, and on two occasions shrapnel burst close to his machine when he was flying at a height of about 3,500 ft. He said that he usually flew at about 4,000 ft., and at that height he was fairly safe, but if he descended the least bit lower the shells became annoying. One day a shell burst just above his aeroplane.

Effimoff, another aviator, is reported to have said that when above Fort Karagach at a height of over 4,000 ft., four bullets hit his aeroplane, and it was also struck by splinters of shell.

In Tripoli an Italian airship used to pay visits to Azizieh and drop bombs. The Turks tried a mountain gun but with no effect. They then obtained a 9-c.m. Krupp, which they mounted specially and it is reported that on the next appearance of the airship, the gun being fired when it was above it, the airship immediately rose rapidly, sailed off to Tripoli and never returned.

It does not seem reasonable to expect that hostile aircraft can be destroyed or driven away by armed aircraft only. The artillery

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must also assist, and to be of use it should be provided with some sort of automatic sight.

The impossibility of doing without the aid of artillery can easily be realized when we consider that a swift destroyer will arrive four minutes after it has been sighted. Can it be expected that destroyers will be continually patrolling and in sufficient numbers to meet such an attack, or that one on the ground will be capable of ascending in time to prevent it? Again, what will happen if the enemy has obtained a local command of the air?

The enemy may take advantage during a gale to despatch with the wind a powerful airship to discover some important move, for it will be in bad weather that such moves will probably be made. The report can be sent back by wireless. Our aeroplanes will probably not be able to manœuvre in the gale, consequently we must rely on our guns.

Aeroplanes and airships will be most useful to artillery in finding targets, and, although they will be able to report the general result of the fire, they will not be as useful as captive balloons and kites for observation, as the observer in a captive balloon or kite can be in direct telephonic communication with the battery commander. In the Italo-Turkish War, it is reported that the Italian artillery with the help of an aeroplane, flown by Capt. Moizo, succeeded in locating the position of the Turkish artillery, and "opened a violent fire which the aeroplane reported as correct and efficacious." At the Battle of Sciara Sciat on 26th October, it is reported that two aeroplanes directed the firing of the mountain artillery and also that of the battleship *Carlo Alberto*.

The following is reported to be the first official communication by the Italians in regard to the use of aeroplanes, dated November 5th, from Tripoli:—"Yesterday Capts. Moizo, Piazza, and De Rada carried out an aeroplane reconnaissance, De Rada successfully trying a new Farman military biplane. Moizo, after having located the position of the enemy's battery, flew over Ain Zara and dropped two bombs into the Arab encampment."

At the Battle of Mukden, the Russians bombarded for several hours a hill where a Japanese battery had been sited the day before; they eventually sent up a balloon and found their mistake, the battery having been withdrawn the previous evening! Every round had been wasted. At an attack in the vicinity of Mukden, a Japanese battalion marched up a hollow road to the north, where it remained under cover; the Russian batteries shortly shelled the spot where it was lying concealed, and it had evidently been discovered by the Russian captive balloon which ascended about half an hour before.

It will of course be necessary to make special arrangements when aircraft are carrying out any special work in connection with artillery. For instance, it will not be possible for an observer to

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correct the fire of a battery if several batteries are firing at once. If an observer is required to observe individual shots he must be connected by telephone to the battery commander, and a captive balloon or a kite only can therefore be used for this purpose. On the other hand aircraft could if necessary indicate hidden targets to several batteries.

Infantry.—A commander may place great reliance on his aircraft, and keep his troops concentrated at important strategical points or railway junctions until required. He could then move them to the desired points by rail if possible, thereby increasing the fighting power of the troops by saving them from fatigue of continual marching. Another point to consider is what would be the least conspicuous formation for the approach to the battlefield?

Infantry would do well to hug the hedgerows whenever possible whilst on the march and when moving forward to the attack. It is possible that it may have to adopt some method of rapid extension from single file, as troops in extended order are difficult to see.

Troops on the march, on the approach of aircraft, would do well to scatter to the sides of the road and remain still. They must remember that it is very easy to pick out a road, as it appears more or less white against the fields, and that a column immediately attracts the eye.

Convoys, etc., when halting, should draw up close behind, or in a wood, as there will be less chance of their being observed if they are close up behind trees, even though the aviator crosses them; guns and limbers at regular distances and in a straight line are easily picked up.

As regards the possible offensive action of aircraft dropping bombs on the troops in defence whilst the final infantry attack is taking place, it appears probable that at this stage of the attack aircraft armed with machine guns could support the infantry especially after the supporting artillery had ceased to fire.

Advantage will often be taken of darkness and inclement weather to carry out important moves, and night marches will probably be the rule in future.

Suppose a commander's plan to have been disclosed to the enemy as the result of an aerial reconnaissance, he will attempt to upset his opponent's plan by moving his troops during the night. Camp fires may have to be abolished, although fires may be lit to deceive the enemy—a ruse successfully used by the Boers when fighting the Basutos some years ago. For this reason travelling kitchens will be a necessity.

If in the Russo-Japanese War the Russians had possessed aircraft at Telissu, the march of the 4th Division would certainly have been discovered. It was undoubtedly the action of this division that resulted in the defeat of the Russians who had no idea of its where-

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abouts. The Russian cavalry stated that they did report its arrival; but the actual fact appears to have been that, owing to lack of sun, the heliograph message did not get through.

It has been recorded that at Liao Yang a captive balloon was used with success by the Russians, and that it was possible to discover from it the Japanese guns even though hidden in the high millet.

If both armies, during the Russo-Japanese Campaign, had had recourse to aviation, it is possible that the operations might have been entirely altered. It has even been suggested that the Battle of Liao Yang might never have taken place.

During the war in the Balkans, a Turkish aviator on one occasion carried out a most useful reconnaissance along the whole front of the Chatalja lines. It had been reported that Derkos had been taken, a very serious matter for the Turks, as in that event the Bulgarians would probably have got through to Constantinople. The aeroplane reconnaissance, however, showed that far from the place having fallen, the Bulgarians had been repulsed in that quarter. It has been very truly stated that information is the groundwork of a sound plan. A commander may have to support his cavalry with a considerable force of infantry and artillery when the opposing armies are close to one another. The infantry will then have to fight to obtain the required information. But by means of aerial reconnaissance it will be possible to obtain reliable information, thus relieving the infantry, and avoiding the extra marching which the "Fog of War" so often entails. Less marching means more rest, the result obtained may have far-reaching effects.

Sieges.—It is very doubtful whether the aircraft of the besieged would be able to compete with that of the besieger, as they would have to ascend from a confined space, and would be the centre of a circle of hostile artillery and aircraft. But communication between a besieged fortress and the outer world could, no doubt, be kept up by means of aircraft.

The besieger, moreover, until he had obtained command of the air, would be forced to have his main standing camps and depôts well out of range of the guns which would otherwise be directed upon them. The Japanese at Port Arthur were able to conceal their camps well within range of the Russian guns, as there were no balloons in Port Arthur.

The Russo-Japanese War gives yet another example of what might have been done with a captive balloon. In order to destroy the fleet in Port Arthur, the Japanese had to take 203-Metre Hill, which was required as an observation station, at a loss of thousands of men. With the aid of one captive balloon a mile or two in rear of their guns, they could have shelled the ships in harbour without this hill and would thus have saved the great loss they suffered.

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At the commencement the Japanese had a balloon at Port Arthur, and it is difficult to understand why it was not tried. On the capture of Namako yama, a hill close to 203-Metre Hill, a valuable point was gained from which to direct their fire against the Russian war vessels. Thinking that there was no further need for their balloon, the Japanese despatched it to the north. The warships generally suffered from the 11-in. howitzer shells; but by collecting in the basin and as close as possible to the south end of Quail Hill, some of the larger ones managed to escape observation to a certain extent. It was therefore considered necessary to take 203-Metre Hill.

Finally it may be possible to carry out firing at night as the aircraft could approach unseen, whilst ships lying at anchor in harbour on a moonlight night could, I think, be easily seen. Also aircraft could drop bombs into a fortress, and this was done frequently at Adrianople causing considerable annoyance.

Savage Warfare.—It may be assumed that there will be neither artillery nor long range rifle fire to contend with in savage warfare. In tropical Africa where the forest is very dense, villages are built in clearings and are connected by narrow tracks. All natives usually adopt the same tactics by erecting stockades across paths close to the villages. Small dirigibles might be used to carry out a reconnaissance, and if considered advisable drop incendiary bombs which would quickly destroy the villages, but aeroplanes could not possibly be used in dense bush as they would have no place to ascend from. For this reason it would be useless to expect any reconnaissance work in the dense forest other than that already described, except where good broad tracks exist.

In a desert country, and also where the thorn bush exists, aircraft would be of great service; in some bush countries, when it may be impossible on the ground to see more than 100 yards ahead, the aerial observer would be able to see quite clearly, as the small thorn trees are not close enough to give cover from above. In such country aeroplanes could, of course, be used.

It is reported that, in Tripoli, the engines suffered from the sand, but the French appear to have used a captive balloon for protective duty in Morocco, with great success.

Finally, the following is a short summary of the conclusions at which we may arrive:—

1. Undoubtedly aerial reconnaissance will have an important influence on strategy and tactics.

2. The independent cavalry will more frequently be liberated from reconnaissance work, and will consequently be able to devote its attention to offensive action.

3. The numbers on protective duties, especially in the absence of the enemy, will probably be reduced. Cavalry will also be kept more concentrated.

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4. As regards field artillery, it is probable that aerial reconnaissance will favour the attack. The attacking artillery will probably be superior to the artillery in defence and the object of the former will be to discover and engage the latter, whilst the latter will probably, to a certain extent, withhold its fire and avoid an engagement until the decisive attack. The attacking artillery want guns as targets. The aim of the defenders will be to conceal themselves and reserve their fire for the infantry : it is the work of the aerial observers to find the targets for the attackers. Artillery generally will, no doubt, have a great effect on the issue of the battle in future ; and aerial reconnaissance will directly assist this arm.

5. A commander will be in possession of accurate and positive information as to the enemy's dispositions at practically the same time as the dispositions are patent to the observers—certainly before the situation has changed materially. He will be able to form his plans with certainty, and he will be able to concentrate his forces.

6. It will be possible to keep the commander in close touch with the course of events on the battlefield : also with the position of the enemy's reserves, and so enable him to strike with his reserves at the right place and at the right time.

7. A commander who has lost command of the air, or whose air service is insufficient, will practically be fighting encounter battles and his tactics will in consequence be cramped.

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FIELD TROOPS.

A Lecture delivered to No. 3 Senior Officers' Class, S.M.E., by CAPT. E. W. COX, R.E.

I. *Historical Sketch.*—Field Troops are the engineers that accompany the British Cavalry Division.

The need of mounted sappers has been felt since the Peninsula Wars. A detachment of sappers of the Guard was sent across country on horseback, to clear a bridge over the Sambre for Napoleon's light cavalry in their advance on Charleroi.

In the American Civil War the cavalry generals on both sides made constant use of mounted pioneers to interrupt communication on their famous raids.

In the Franco-Prussian War the mounted pioneers with the German cavalry were credited with a large share in the victory of Wörth, as, by cutting the railway between Saargemünd and Bitsch, they prevented the arrival of French reinforcements, while the 6th German Cavalry Division used its mounted sappers to destroy the railways radiating from Vierzon, and to bridge the Rhine-Marne Canal.

Gourko, in 1876, used mounted pioneers to assist the passage of his wagons over the Balkan Pass, and afterwards in destroying railways and telegraphs.

In the later stages of the South African War, every column had either a field troop or a detachment of mounted sappers from field companies attached to it.

At the present day mounted engineers, under various names, are allotted to the cavalry divisions of France, Germany, Austria, and Russia, so that there can be no doubt that the need of them is universally recognized.

In order to appreciate the true value of field troops as they are to-day, it is necessary to review very briefly their origin and their history. In the Egyptian War of 1885 it was decided to try the experiment of adding a detachment of mounted engineers to the corps of mounted infantry. This experiment proved so successful that a permanent "mounted detachment" was created in 1887, as the nucleus of a larger force to be raised in war. This "mounted detachment" was gradually increased between 1887 and 1898, and the first year of the South African War saw it expanded into four field troops.*

At the end of the war three troops returned to England, and

* A short summary of the employment of the field troops during the South African War is given in an appendix.

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one remained in South Africa. One of the home troops was soon disbanded, leaving three troops to provide for three cavalry brigades.

In 1904 the peace establishment was reduced, but in 1907 two more troops were formed, making five in all—four for the cavalry division at home, and one for the cavalry in South Africa.

Before these two extra troops were sanctioned, the possibility of a reduction in the peace establishment must have been considered very carefully. No reduction was made, however, and it was not till five years later, *i.e.*, in the spring of 1912, that a further reduction was ordered, at a gross saving on all the troops of some £10,000 a year.

Such is a very rough outline of the history of the field troops. Is there anything to be learnt from it? One fact stands out clear beyond all others: that peace is the only enemy the field troops have to fear. The same may, perhaps, be said of every arm, but it can be said more truly of the engineer arm than of any other, and of the field troops most truly of all.

II. *Duties of Field Troops compared with those of Field Companies* (*F.S. Regns., Part I., Sec. 5, paras. 1 to 3*).—It is laid down in *Field Service Regulations*, Part I., Section 5, para. 1, under "The Fighting Troops and Their Characteristics," that engineer field troops are allotted to a cavalry division to assist the mounted troops in the passage of rivers, in the improvement of roads and other means of communication, in placing localities in a state of defence, and in interrupting the enemy's communications by the destruction of bridges, railways, and telegraphs.*

It should be noted that only two of these duties are ever carried out on manœuvres, namely, water supply and rafting. The pace of both the advance and the fight is accelerated to such a degree that cavalry cannot wait for work that would have to be done in war.

Paragraph 2 defines the characteristics of field companies, which form part of an infantry division, to be the construction of works of defence, and the improvement, or construction, of roadways and bridges.† Both troops and companies assist in the preparation and maintenance of watering arrangements.

These two paragraphs emphasize very distinctly the chief difference between the duties of field troops and field companies. The troops are too small, except for demolitions, to do more than assist and supervise working parties of dismounted cavalrymen or civilian labourers, while field companies are expected to work without, as well as with, help from other sources. Special prominence was given to this duty of supervision by Sir Douglas Haig in his report on the Cavalry Divisional Training of 1909.

Another difference is the restriction which is placed on the work of field troops by the pace at which cavalry move. A troop cannot

* These duties are amplified in *Engineer Training*, Sections 114 and 115.
† See also *Engineer Training*, Sections 113 and 115.

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undertake work which would delay it to such an extent that it would lose touch with the force to which it is attached.

Again, a field troop is not expected to take part in siege warfare, whereas sapping and mining form one of the most important duties that may fall to the lot of a field company.

III. *Organization and Equipment of Field Troops compared with those of Field Companies.*—In order that the field troops may be used to the greatest advantage in war, the four troops at home are organized as cavalry divisional engineers, and a lieutenant-colonel, with an adjutant, is appointed to superintend their training in peace and to command them in war. As, however, the brigades of the cavalry division are quartered at different stations, the field troops are not kept together in peace : each is attached to a cavalry brigade, in order that both arms may be in the closest possible touch, one with the other, and to give the cavalry brigadiers an opportunity of learning the possibilities of field troops, of using them in brigade training, and of keeping them up to a high standard of horsemastership.

Each troop consists, in peace, of a captain, a subaltern, 31 non-commissioned officers and sappers, and 20 drivers, with 20 riding and 26 draught horses. This establishment is increased in war by 1 subaltern, 14 non-commissioned officers and sappers, and 7 drivers, with corresponding additions to the number of horses. In war, the officers, the non-commissioned officers, and 18 sappers are mounted, while 15 sappers ride bicycles.

Entrenching, cutting, and carpentering tools are carried in two double tool carts, together with water supply stores and explosives. The tool carts are drawn by 6-horse teams and are expected to keep up with the mounted men. In order that field troops may be equal to any emergency, certain tools are always tied on to the bicycles or carried by the mounted sappers in tool buckets, small quantities of explosives can be carried in sandbags *en banderole* by both mounted men and cyclists, and five pack horses are available for heavy tools, large quantities of explosives, and electric generators.

A collapsible boat equipment is carried in a special wagon. This equipment provides a raft which will take the heaviest-horsed vehicle in the cavalry division. Under the most favourable conditions it takes 35 minutes to unload the wagon and get the first raft load across a river 100 yards wide.

Lastly, there is a G.S. wagon for odd stores and baggage, in addition to the usual supply wagon, cook's cart, and water cart.

The organization and equipment of a field company are naturally somewhat different. At present there are two companies to each infantry division. The need of a third has been felt so keenly that a special enquiry was set on foot, to see whether some reductions could not be carried out in other branches of the corps, in order to cancel the additional expenditure which the six new companies would

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entail. The reductions have been effected, but the infantry divisions are still waiting for the third field companies.

The peace establishment is 3 officers and 116 sapper non-commissioned officers and men, expanded in war to 6 officers and 157 sapper non-commissioned officers and men.

A field company is therefore more than twice as strong as a field troop.

The sappers are dismounted, except for 32 cyclists, and their engineering equipment is carried in four double tool carts, while four pack horses are provided for emergencies.

The chief difference between the equipment of a field troop and that of a field company lies in the river-crossing equipment. A troop has only a raft, while a company has 75 ft. of pontoon bridge, which can be joined up with the equipment of the other divisional field company and of half a bridging train, to form a bridge 120 yards long; in all normal cases, therefore, the waste of time that is inevitable in rafting or bridge building is avoided.

IV. *Recruiting and Training of Field Troops compared with those of Field Companies.*—Sappers who enlist for service in field troops are sent to Aldershot, and are trained in the depôt in drill, musketry, riding, and military engineering, before they are posted to units.

Dismounted sappers, on the other hand, are sent to Chatham on enlistment, and are put through their recruit's courses of drill, musketry, and military engineering, in the Training Battalion. The terms of service are "six and six" for both mounted and dismounted sappers.

The drivers of every unit in the corps are enlisted and trained at Aldershot, their terms of service being "two and ten."

The training of both troops and companies may be roughly divided into two distinct periods during the year—technical training at trades during the winter and spring, and military training during the summer and autumn.

The military training of a troop is rather different from that of a company. Every sapper, whether in a troop or a company, must be, first of all, a skilled field engineer; but a field troop sapper, in addition, must be able not only to ride, to look after his horse, to shoot and to swim, but also to read a map, find his way at night, and act, under any circumstances, on his own initiative.

A brief summary of the annual training of the Aldershot troop is as follows:—

When the annual manœuvres are over, every sapper settles down to work at his trade till the end of the year. In January or February he undergoes half troop training; each half troop in turn is trained for a month in riding (up to M.I. standard), horse-mastership, elementary field engineering, musketry (preliminary training), map reading by day and night, and semaphore, with daily lectures on the various subjects.

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The sappers of the half troop which is not under training are either working at their trades or on furlough. March is devoted to drills, both mounted and dismounted, and the annual musketry course.

Thirty working days in April and May are spent on the annual military engineering course, at the end of which the sappers return to their trades, while the non-commissioned officers give a three weeks' course to 15 cavalry pioneers from each regiment in the brigade. The sappers remain at their trades, and the non-commissioned officers work at day and night reconnaissance, till the troop, with the cavalry pioneers, goes under canvas for three weeks of summer training, *i.e.*, bridging, rafting, the use of every kind of expedient for river crossing, and horse swimming. This is followed by three weeks of combined training, during which the three troops stationed in England are trained, under the officer who will command them in war, both in practical engineering and in tactical schemes which have been submitted to a cavalry officer on the General Staff. Then follow brigade training, cavalry divisional training, and the various manœuvres.

V. *Examples of Employment of Field Troops in Narrative Form.*—It is extremely difficult to grasp the possibilities of a unit, the characteristics and duties of which are unfamiliar, if the only information that can be obtained is confined to the generalities laid down in *Field Service Regulations*, Part I., and *Engineer Training*.

The duties that may fall to field troops will therefore be enumerated in greater detail, and the less obvious ones will be illustrated from the schemes set during the combined training of the last two years.

(*a*) Entrainment and Detrainment.—Approaches would be made or improved, ramps constructed, and sidings laid down.

(*b*) Passage of Rivers.—The troops would be responsible for the rafting of the limbered G.S. wagons and the R.H.A. guns and wagons; the cavalry regiments and all the gunner horses would swim.

Field troops are able to practice horse swimming much more regularly than cavalry regiments; every horse, both riding and draught, on every day of summer training, is made to swim across a river and back, and it is suggested that these well-trained horses should be used to give a lead, whenever cavalry regiments are likely to lose valuable time through the refusal of their horses to take the water.

(*c*) Engineering Reconnaissance.—It has been already explained that field troops cannot carry out any piece of protracted engineering, but they may often be able to send back to the C.R.E. of an infantry division in rear not only a report of the work that awaits him, but valuable information about tools and materials.

In the unusual event of mounted troops investing a locality, the engineering reconnaissance would take the form of impressing tools, materials, transport, and possibly labour.

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The work of a field troop in carrying out the three duties that have already been outlined is so obvious that no illustration is necessary.

(*d*) Rapid reconnaissance of a position and deliberate preparation for defence.

(*e*) Defence of river crossings.

(*f*) Defence of close billets.

(*g*) Bridge demolitions and hasty defence of localities.

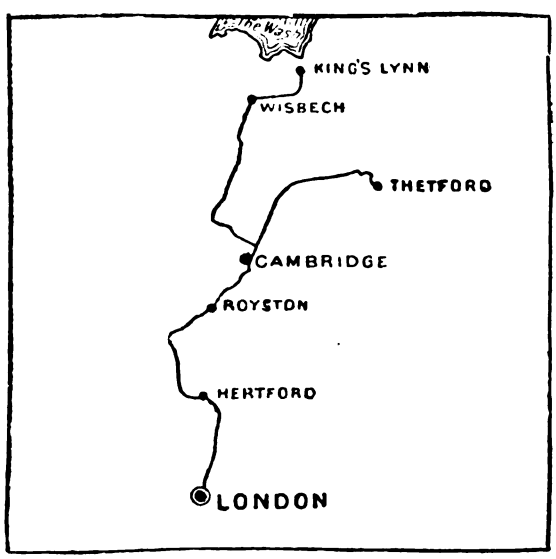
(*h*) Raid on railway communications.

(*i*) River crossing at night.

(*j*) Fighting.

These duties (*c*) to (*j*) will be illustrated by a short narrative.

On June 1st, 1912, war broke out on the Continent between Blueland and Blackland. Blueland quickly gained control of the sea north of the English Channel, and, just as England had completed the mobilization of her one cavalry and six infantry divisions, and was preparing to send them to the Continent to help Blackland, Blueland invaded England with a force of one cavalry division, cyclists, and two corps, which landed at King's Lynn and marched on London. England concentrated her infantry by rail south of Cambridge, with the cavalry division about Royston (Map A).



Scale 1 inch = 40 miles

MAP A.

On June 15th the cavalry division moved forward to make good the high ground between Gunner's Hall and Cherry Hinton (Map B), and the field troops were ordered to strengthen the position between Worsted Lodge and Reservoir.

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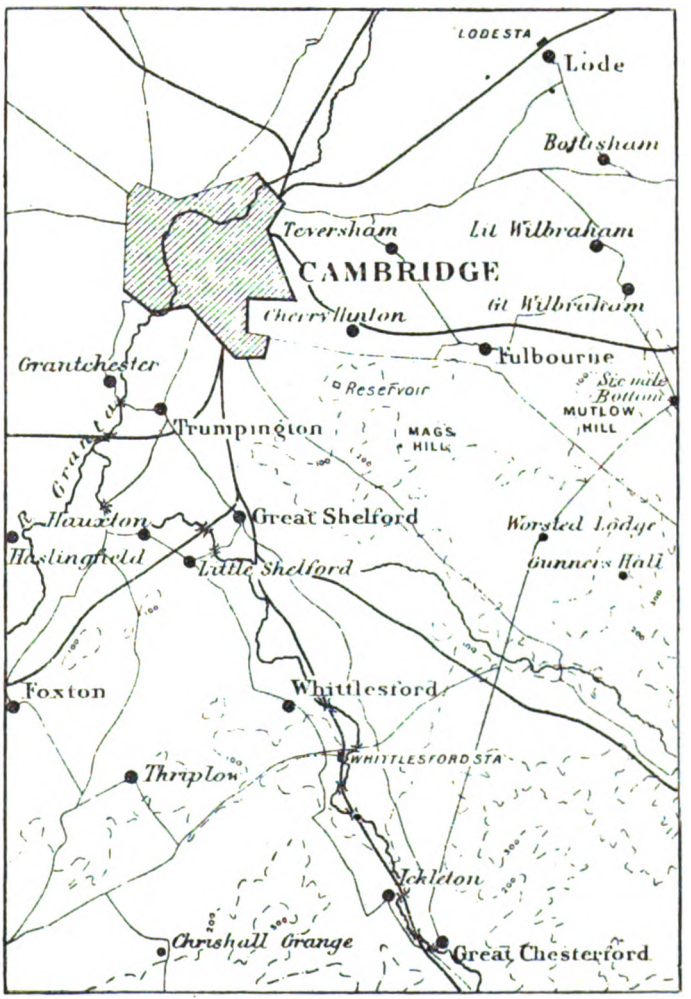

Scale ~~1/63360~~ or 1in. to 2·66 Miles

Mile 1 ½ 0 1 2 3 4 5 6 Miles

MAP B

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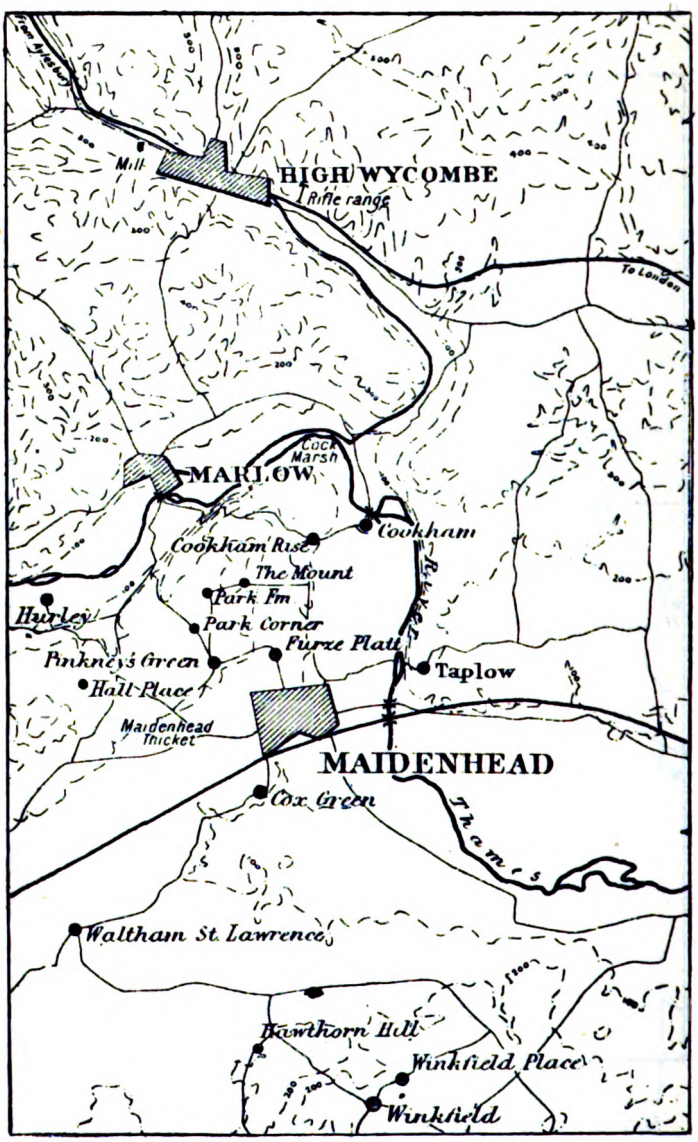

MAP C

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The C.R.E. allotted sections to the troop commanders and ordered them to meet him with their reports at a central rendezvous.

The troop commanders had to reconnoitre their sections at the trot in order to reach the rendezvous in time. While the C.R.E. wrote his report the troops collected tools and materials and began work. On receipt of the report the G.O.C. detailed one regiment as a working party, and sent the report to the C.-in-C. in rear, to inform him of the possible expansion of the line.

The cavalry division held the defensive position on June 16th, but were hard pressed towards the evening, and on the 17th the field troops were ordered to hold the river crossings over the Granta while the division retired to the line Grantchester-Whittlesford. Three squadrons were detailed to assist the field troops, who had no time for more than the most hurried reconnaissance before the retirement began. As the regiments crossed the river they were met by mounted sappers who led them to their positions.

On the next day the infantry columns began to arrive and the cavalry division recrossed the Granta and went into close billets at Six-Mile Bottom, Little Wilbraham, and Lode. The field troops were attached to brigades for the night, arranged water supply, and assisted the brigades to prepare their billets for defence.

On June 19th and 20th the cavalry division drove the enemy back to Thetford (Map A), but on the afternoon of the 20th, reinforcements for the enemy were reported to be advancing on Cambridge from Wisbech. The C.-in-C. decided to change his line of communications to the line Hertford-Cambridge, and on June 22nd, the field troops were ordered to destroy all bridges over the Granta from Whittlesford Station to Great Chesterford, to prevent any crossing between those points, and to hold Ickleton. The C.R.E. allotted bridges and detailed patrols. The bridges were blown up on receipt of an order from the commander of the rear guard.

To illustrate a river crossing at night and a railway raid, another narrative is necessary.

In July, 1911, war broke out between two states north and south of the Thames.

The south were ready, the north unprepared.

To cover the mobilization of their regulars, the north assembled a large force of local levies, which, with 1 cavalry brigade, 2 batteries Royal Horse Artillery, and a field troop, crossed the frontier, and on July 10th encountered the enemy some 30 miles south of Maidenhead (Map C).

Heavy fighting took place on the 11th and 12th, and by 4 p.m. on the 12th the northern forces were driven back on the line Hurley-Maidenhead Thicket-Maidenhead.

Maidenhead was held by one cavalry regiment, while Cookham

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and Marlow bridgeheads were defended by infantry from the local levies, who had prepared the bridges for demolition.

At 6 p.m. the local M.I. were ordered to retire across the Thames at Marlow and blow up the bridge.

The cavalry brigade covered this retirement, intending to cross at Cookham and blow up the bridge there, while the regiment in Maidenhead was ordered to hold on until the bridges at Marlow and Cookham had been destroyed.

At 11 p.m. Marlow Bridge was blown up, and shortly afterwards the R.H.A. and field troop, who were waiting at Park Farm, were ordered to retire to Cookham. Just as they passed through Cookham Rise a violent explosion was heard from the east, and word was brought back that Cookham Bridge had been destroyed.

The field troop was ordered to get the guns across the river at Cock Marsh. Volunteers swam the river with their horses, and with this lead the majority of the horses swam over free. The rest were taken over behind the raft, which made 30 journeys, ferrying the last wagon over at 4.30 a.m.

From July 13th to 15th the south made several unsuccessful attempts to force the passage of the river, and on the 16th the cavalry division moved to the west to cross above Reading, leaving a holding force of one cavalry brigade, one battery of horse artillery, and one mounted sapper detachment on the line Hurley-Maidenhead.

At 6 p.m. on the 16th information was received that large quantities of stores were being removed by rail from High Wycombe to London and Aylesbury. Scouts reported that the outpost line along the river had been weakened, and that the turning movement at Reading was beginning to cause a general retirement of the northern force.

The O.C. mounted detachment was ordered to cut the railway east and west of High Wycombe that night.

Three parties, each of one officer, one non-commissioned officer, and two sappers, swam the river as soon as it was dark, and went across country on foot. One party was captured, the other two got through—one blowing up a short rail at a curve, and the other dropping an iron girder over a culvert.

They hid in the woods on the enemy's side of the railway during the next day, and rejoined the unit the next night.

VI. *Further Examples of the Way in which Field Troops can help Cavalry in War.*—It has already been stated that water supply and rafting are the only duties in which field troops can prove their value on peace manœuvres. An attempt has been made, by quoting from history, and by giving an account of present-day training, to illustrate the *rôle* of field troops in war, and the various ways in which they can be of assistance to cavalry. There are still some points, however, which have escaped attention, and these can best be illustrated by

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imagining the questions that a cavalry commander might be expected to ask himself, when studying, in peace, the best way of getting the utmost out of his field troops in war.

(i.). What is the best place for the troops on the line of march?

The answer to this depends of course very largely on local circumstances, but certain principles are clear. A field troop officer, with, possibly, six mounted N.C.O.'s and sappers, should invariably accompany the foremost troops of the advanced guard.

This is laid down very distinctly in *Engineer Training*, Section 96, para. 3. A well-trained officer will notice at once any opportunity there may be of helping the cavalry, and by sending word back to the C.R.E. will enable the latter to prepare for work before he actually reaches the scene of it.

This implies that the C.R.E. must be in the closest touch with the headquarters staff. The necessity is self-evident, and is anticipated in *Engineer Training*, Section 95, para. 1. Until there is work for the troops, the C.R.E. must be where he will get information and orders without delay in their transmission. This principle should be maintained when a field troop is allotted to a detached cavalry brigade. The troop commander is then the C.R.E. of the brigade, and should invariably be with his brigadier until he gets work for his unit.

The main body of the Sappers, with tool carts and pack horses, may very well follow the gunners, unless it is more expedient to use them to assist the transport or train. The latter duty should never be assigned to the troops in peace, as it is unnecessary and would discourage both officers and men.

The heavy G.S. wagon, and the boat wagon, should be relegated to the train, the boat wagon being kept with the 1st line transport only when there is a possibility of using it.

A cavalry commander can, in this way, free his fighting troops from all encumbrances, as they would be accompanied by nothing less mobile than mounted men, cyclists, and limbered wagons.

Another case may arise. If the enemy is met unexpectedly, and the 1st line transport is uncomfortably close, it might be a sound plan to send the main body of the Sappers back to the transport, with orders to take it to the nearest defensible position, such as a village, and to prevent its capture.

A cavalry commander should never forget that he possesses over 40 rifles in each troop, which might be invaluable at a *point d'appui*. Musketry training in field troops has been raised to the same standard as that of cavalry regiments, and it is expressly stated in *Engineer Training*, Section III., that fighting is one of the duties of engineers.

This possibility should be borne in mind even if it is not con-

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sidered necessary to take special precautions for the safety of the transport.

The rifles of the field troops could be used, as they often were in the last war, to escort machine guns, or R.H.A., or even to assist dismounted cavalry.

Peace manœuvres would be rendered much more interesting to field troops if cavalry commanders would remember this, and would occasionally give them some other order than to follow the guns.

Lastly, when the cavalry are going to billets or bivouacs for the night, the troops should be sent on well ahead, so that they can have something ready, in the way of water supply, by the time the cavalry begin to arrive. This is laid down very clearly in *Engineer Training*, Section 96, para. 8.

It is a point that can be practised every day on peace manœuvres, but only if the C.R.E. is with the headquarters staff, and gets his orders without any loss of time.

(ii.). What is the best use to make of field troops in the cavalry fight ?

This question has been answered mainly under (i.) above. Further uses will depend chiefly on the nature of the country. In open country the mounted sappers, all of whom carry tools, might be used as an escort to machine guns or R.H.A. In enclosed country, some mounted sappers with cutting tools should certainly be with the regiments, while the remainder, with the cyclists, should be with the R.H.A., in order to cut gaps in hedges, break down fences, and generally facilitate their movements.

Whether the country is open or enclosed, the tool carts and pack loads should be left under cover, or, possibly, sent back to the 1st line transport. They are not wanted with the fighting troops.

(iii.). How can field troops be of assistance when infantry begin to relieve cavalry from the defence of a position ?

They should be detailed to improve lateral communications on both flanks, so that the regiments and guns can move off easily and quietly, without exposing themselves in close formations to hostile fire.

(iv.). What is the object of training cavalry pioneers, and how will they be used in war ?

This can only be answered in detail by a study of the reports on cavalry pioneer courses, but the three main objects of pioneer training may be said to be :—

(*a*) To render cavalry regiments independent of any other arm in the passage of rivers. Experiments are being made with an air-bag equipment which, it is hoped, may be issued to cavalry regiments in some mobile wagon, but, apart from this, pioneers are trained in every river-crossing

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expedient. That this training is essential may be gathered from the fact that a field troop cannot raft one R.H.A. battery across a river 100 yards wide under two hours. The cavalry must be independent, therefore, unless valuable time is to be lost at every river crossing.

(*b*) To enable cavalry to carry out small demolitions, such as the destruction of telegraphs, telegraph and railway offices, railway plant, permanent way, etc.

(*c*) To give pioneers an elementary knowledge of field engineering, and to accustom them to the use of their pioneer equipment, so that, when it is necessary for the C.R.E. to call upon the cavalry for a working party, the men who are detailed will have a good idea of what they are expected to do.

VII. *How Cavalry can Help Field Troops.*—True co-operation depends on intimate knowledge and mutual confidence.

Cavalry commanders can inspire confidence by using field troops, not only theoretically on brigade and divisional staff tours, but practically on manœuvres, on the lines already indicated.

An intimate knowledge of field troops will induce cavalry commanders to press for certain reforms which are essential for the efficiency of the units. These reforms may be outlined under the headings :—

A.—Equipment.

B.—Establishment.

A.—(i.). The collapsible boat equipment can, at present, only be used as a raft. It should be so altered and strengthened that it could be used in bridge. The cavalry divisional river crossing equipment would then be 75 ft. to 80 ft. of bridge, which would save many valuable hours in the passage of small rivers and canals.

With the present troop equipment the cavalry division (fighting troops and 1st line transport) will take over eight hours to cross a small river, even if the regiments are entirely independent of the field troops.

(ii.) The present pack equipment is impossible for fast work. Not only is the principle of pack transport for fast moving units wrongly applied,* in that five horses are loaded up with 2 cwt. each from the command " Mobilize," instead of being loaded only to meet an emergency, but the equipment is bad in every detail ; the weight is too high, which means a badly balanced load and a sore back, the loads are noisy, the entrenching tools need elaborate lashing to prevent them falling out even at the walk, and none but an unnaturally long-backed horse can carry the loads without being galled on either the neck or the quarters.

* When pack horses were first introduced into field troops, they carried empty cases and racks.

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The mortality among pack horses with cavalry in South Africa was exceptionally high, but undoubtedly there will be occasions when pack horses are indispensable.

An improved saddle, such as the wireless pattern, should be substituted for the present pack saddle, and the loads might be carried in two limbered G.S. wagons until required, when they could be transferred to the backs of the lead pairs in the 4-horse teams.

This would give increased mobility, and would have the further advantage of providing the troops with a vehicle that could be used for carting, the need of which was constantly felt in the last war.

The proposal would mean a reduction of the present war establishment by one man and six horses, so presumably there would be no financial objection.

(iii.). Under present arrangements there is no reserve of explosives nearer than the advanced depôt. A reserve of 100 per cent. of the war equipment should be carried in the horse artillery ammunition column.

There is no need to labour this point. Every campaign since the beginning of the last century has proved that raids on communications and the demolition of bridges are the most effective of a field troop's duties. The quantity of explosives carried by a field troop is so small that one-third of it might be expended on one raid alone, and the remainder would not blow up more than two bridges of normal dimensions.

In a matter of such vital importance it is wrong to rely upon the cavalry regiments to supply a reserve for the field troops. Their explosives are for their own pioneers, and are not brigaded, but scattered in squadron wagons. The matter cannot be left to chance ; the C.R.E. should know exactly where to put his hand on a large reserve of such an essential store.

(iv.). It would seem wise to provide the bicycles with clips for heavy tools, and leather or canvas bags for small stores. Spare parts should also be issued, as experience shows that the passage of one regiment alone over a side road is sufficient to puncture 30 per cent. of the bicycles.

B.—Reforms in the equipment, however, are of secondary importance.

Battles are won by men, not *matériel.*

The last reduction in the peace establishment of field troops reacts to the detriment of both technical and military training. The effect on military training will be considered first, as it is one that may not be discovered till the outbreak of war.

(i.). How is the training of the officers affected ?

It may be assumed that the subaltern detailed to join a field troop on mobilization will be selected for his special qualifications, but, even so, his training with the men he is to lead in war will be limited to the three weeks in the year during which he attends combined

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training, and he will join with but the most superficial knowledge, not only of his duties, but also of the men under his command. Yet the experience of war shows that in the first week of a campaign he may be called upon to carry out a task, such as a railway raid at night, for the proper execution of which he must have established the utmost confidence between his men and himself.

As regards the officers posted to the troops in peace, there can be no continuity in training when a troop commander is posted to another unit, no officer can be spared to attend courses at Netheravon or elsewhere, either as an instructor or as a pupil, and the subalterns are deprived of all the advantages of responsibility and initiative which the half troop organization involved.

The case of the N.C.O.'s and men is equally striking.

It is accepted as an axiom in every modern army that, as mounted men deteriorate very rapidly in the reserve, the peace strength of a mounted unit should never, under any circumstances, be less than two-thirds of the war strength. The peace establishment of a cavalry regiment is in excess of its war establishment; the peace strength of the gunners of a horse artillery brigade, even on lower establishment, is over 80 per cent. of their war strength. The condition of the cavalry and horse artillery, therefore, is a happy one. But the peace establishment of the sappers of a field troop has been reduced to 60 per cent. of the war establishment, which is well below the recognized minimum.

Field troop sappers must be individualists to an even greater extent than the men of any other arm; they never work in large parties, and a man who is untrained, or has grown rusty on the reserve, is worse than useless in war.

(ii.). But by far the worst result of the reduction in peace establishment is the impossibility of keeping the Sappers at their trades in winter.

In some quarters the field troops, in this very question of trades, are undoubtedly suspect.

It is said that technical training is sacrificed to riding and drill. Whatever may have been the ground for such a charge in the past, there has been no ground whatever in recent years. There is not a field troop officer who does not know that the well-being of his unit in peace, and its efficiency in war, depend primarily on skill at trades.

Good tradesmen, unless they are convinced that they will have an opportunity of improving their skill regularly every year, will not enlist for mounted service, and yet the field troops, in order that they may be equal to all the demands that may be made upon them in war, must be able to draw upon the most intelligent class of men that enlists in the Royal Engineers.

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APPENDIX.

FIELD TROOPS IN THE SOUTH AFRICAN WAR.

I.—FORMATION AND EXPANSION.

December, 1899.—1st Field Troop (headquarters and three field sections) landed; no other field troops existed.

April, 1900.—2nd Field Troop formed from field and fortress sappers, with N.C.O.'s and men of M.I.

April, 1900.—3rd Field Troop formed from 2nd Balloon Section, for work with mounted brigade in Natal.

June, 1900.—4th Field Troop formed from 3rd Field Section of 1st Field Troop, for work with Broadwood's Cavalry Brigade.

II.—SUMMARY OF EMPLOYMENT.

December, 1899, to February, 1900, Cape Colony East.—Dismounted action with cavalry—machine gun emplacements—road making—ammunition lift on Coleskop—improvement of drifts—water supply.

February to May, 1900, Relief of Kimberley and March to Bloemfontein.—Destruction of ammunition—gun emplacements—river crossing with collapsible boats—railway and telegraph cut at Ferreira Spruit—successful raid on railway north of Bloemfontein—repair of captured engines and of permanent way—defence of outposts—accessory buildings for hospitals.

May to June, 1900, Advance on Pretoria.—Successful raid on railway north of Kroonstad—telegraph and railway cut at Roodepoort—railway cut at Rustenberg Road.

June to September, 1900, Advance from Pretoria to Koomati Poort.—Infantry positions fortified at Uitkijk and Rockdale—railway reconnaissance—repair of engines and permanent way at Barberton.

September, 1900, to April, 1901, Drives.—Normal troop duties as above.

April, 1901, to end of war, Guerilla Warfare.—Erection of blockhouses.

N.C.O.'s and men of Field Troops were awarded 1 Victoria Cross and 7 Distinguished Conduct Medals.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

(*Continued*).

By MAJOR H. BIDDULPH, R.E.

OPERATIONS IN THE DECCAN, 1803.

THE operations in the Deccan were undertaken by two forces acting in conjunction, viz. :—that commanded by Major-General the Hon. A. Wellesley, and the Hyderabad Subsidiary Force commanded by Colonel Jas. Stevenson, of the Madras Cavalry.

Wellesley's force was portion of an army of observation, 19,000 strong, assembled at Hurryhur on the N.W. Frontier of Mysore in November, 1802, under the command of Lieut.-General J. Stuart.

Wellesley marched from Hurryhur on the 9th March, 1803, through the Mahratta territory *en route* for Poona, and on the 15th April was in touch with Stevenson's force at Akloos on the Neera River.

The composition of the two forces, March, 1803, was as follows :—

Wellesley's Force.

Cavalry :—Colonel T. Dallas, 4th Madras N. Cavalry (succeeded by Lieut.-Colonel P. Maxwell, 19th Light Dragoons, who was killed 23. 9. 03).
H.M. 19th Light Dragoons (412 sabres).
4th, 5th, and 7th Madras N. Cavalry (1,297 sabres).

Artillery :—Capt. M. Beauman, Madras Artillery (108 gunners, 206 Lascars).

Guides :—Ensign G. Rowley, Madras Engineers. (Died 28. 6. 03).

Pioneers :—1st Battn. Madras Pioneers (704 R. & F.). Capt. W. P. Heitland, 6th M.N.I.

1st Infantry Brigade :—Lieut.-Col. W. Harness, H.M. 80th Foot.
H.M. Scotch Brigade (1,013 R. & F.). 1-2nd, 2-3rd, and 2-12th Madras N. Infantry (3,003 R. & F.).

2nd Infantry Brigade :—Lieut.-Colonel W. Wallace, H.M. 74th Foot.
H.M. 74th Foot (754 R. & F.). 1-3rd, 1-8th, and 2-18th Madras N. Infantry (3,120 R. & F.).

Attached :—2,400 Mysore Horse; 3,000 Peishwa's Horse.

Hyderabad Subsidiary Force.

Colonel Jas. Stevenson, Madras Cavalry.

Cavalry :—Lieut.-Colonel Hon. A. Sentleger, 6th Madras N.C.
3rd and 6th Madras N. Cavalry (1,018 sabres).

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Artillery :—Capt. U. Burke, Madras Artillery (168 gunners, 310 Lascars).
Pioneers :—2 Companies 2nd Battn. Madras Pioneers (206 R. & F.)
1st Infantry Brigade :—Lieut.-Colonel H. Maclean, 2-9th M.N.I. 2-2nd, 1-6th and 2-9th Madras N. Infantry (3,849 R. & F.).
2nd Infantry Brigade :—Lt.-Col. J. Haliburton, 2-7th M.N.I. 2-7th, 1-11th and 2-11th Madras N. Infantry (3,333 R. & F.).
Attached :—7,000 horse, 5,000 infantry, 40 guns, Nizam's Army.

Certain changes were made in the composition of these forces, which may be noted here :—H.M. 78th Foot sailed to Bombay from Fort William, and joined Wellesley early in May, replacing the Scotch Brigade in the 1st Infantry Brigade, which had been transferred to Stevenson's force on 16th April under orders from Lieut.-General Stuart.

Poona was reached on the 20th April, just in time to save its destruction by the Mahrattas, and arrangements were made for the return of the Peishwa to his capital from Bombay, whither he had fled ; and a garrison consisting of 5 companies H.M. 84th Foot and some Native troops installed there. At this time Wellesley's artillery was strengthened by the addition of the 3rd and 5th Companies, Bombay Artillery, and Capt. J. Johnson, Bombay Engineers, joined his Staff as Chief Engineer.

The first offensive action against Scindiah was the capture of the town and fort of Ahmednuggar, 8th—11th August, 1803, by Wellesley's division, 4 British officers and 26 other ranks being killed, and 2 British officers and 109 other ranks wounded.

The garrison left in Ahmednuggar consisted of a detachment of artillery, 30 men of H.M. 84th Foot, and the 2-3rd Madras N. Infantry from Wellesley's 1st Brigade. The next move was to try and bring to battle the forces of Scindiah and Berar, which had invaded the Nizam's territories. Wellesley had an interview with Colonel John Collins, recently Resident at Scindiah's court, an extremely able officer, nicknamed " King " Collins from the regal pomp which he maintained. Being an old man of curious appearance and dress, he excited a good deal of amusement in the young Major-General, 34 years old, and his Staff. " King " Collins's parting piece of advice to Wellesley was, " Well, General, as for their cavalry, you can ride over them, but their guns and their infantry will astonish you." The staff officer, who was present and records this incident, adds that as they rode home laughing at Colonel Collins, they little thought how soon they were to realize the truth of his warning.

The pursuit of Scindiah continued into September, till early on the 23rd September Wellesley was within striking distance of the combined armies of Scindiah and Berar.

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The plan had been for Wellesley's and Stevenson's divisions, which were practically in touch with each other, to make independent marches and attack the enemy simultaneously. They had met on the 21st September and arranged for a joint attack early on the 24th. Owing to the confusion that occurred between the name of the village and the district of Bokerdun, the unexpected difficulty of the country which Stevenson had to traverse, and the attack being commenced by Wellesley on the 23rd, this plan miscarried. Stevenson's force was unable to come into action at all, and Wellesley hardly gained the victory of Assye at the cost of nearly one-fourth of his force. Scindiah's artillery and regular infantry fully justified the opinion that Collins had expressed; their drill and fire discipline almost turned the scale against the British.

The enemy were found to be in line behind the Kaitna River, close to its junction with the Juah River, which was in their rear; and Wellesley, making a flank march from the right to the left of the enemy's front, determined to attack their left flank, as he judged from the relative positions of two villages (Peepulgaon and Waroor) that there must be a ford across the Kaitna at this point.

This proved to be the case, but while this was going on, the enemy changed front to their left with rapidity and precision, and Wellesley's force was shut up in the narrow **V** formed by the junction of the Kaitna and the Juah, with the enemy in line across the top of the **V**, from river to river, their left flank resting on Assye.

The right of the line, consisting of the picquets of the previous night, followed by the 74th Foot, led the attack directly on to the village of Assye, which was held strongly by the enemy. This attack was in a direction towards their right front, and was led by Lieut.-Colonel Wm. Orrok, 1-8th M.N.I., the officer commanding the picquets. Wellesley (who had intended the attack to be clear of Assye) acknowledged that it was impossible for any man to lead troops into a hotter fire than was done by Colonel Orrok, whose name he himself does not disclose; and the results justify the statement. With the exception of the 1-2nd M.N.I. which remained in rear with the baggage guard, the losses of the picquets are lumped with their regiments, but the casualties of the picquet of the 1-4th M.N.I. amounted to 21 killed, 22 wounded and 3 missing, out of a strength of about 50. The 74th which supported the picquets lost 11 officers, and 113 men killed, and 6 officers and 271 men wounded, a total of 401 casualties out of about 550 of all ranks. The right of the British line was practically destroyed by the fire of the enemy's artillery which was massed on this flank.

The British attack formation was one of two lines of infantry with the cavalry in reserve in the third line; the artillery was posted in the intervals between the regiments. The cavalry did good service during the day by their brilliant charges, and lost their

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brigadier, Lieut.-Colonel P. Maxwell, 19th Light Dragoons, toward the close of the battle in a final but unsuccessful charge. The advance of the centre and left of the British line was unchecked. the 78th Foot being on the left, and the line wheeled round to the right, pivoted on their shattered right and the village of Assye.

The enemy's artillery, being drawn by bullocks, was captured during the advance, but many of the Mahratta gunners remained by their guns prone on the earth and had the audacity to open fire again on the rear of the advancing British line, after the infantry had passed over them, and inflicted great damage. A considerable part of their infantry left the field in unbroken order, across the Juah, but the loss of their guns, 102 pieces in all, was a serious one; seven stand of colours were also captured. The British casualties numbered 428 killed, and 1,138 wounded, no less than 53 British officers being among them. The numbers under fire were about 6,000 rank and file; these figures do not include the irregular cavalry which lost only one man that day.

The 1-3rd and the 2-18th M.N.I. were not present at the battle, as they had been sent towards Poona on the 20th September, three days before; while on the other hand the 1-4th and 1-10th M.N.I., which had been despatched with convoys by Lieut.-General Stuart at different dates, were both engaged. The 2-3rd M.N.I. was of course absent, as it had been left at Ahmednuggar.

The losses among the *personnel* of Wellesley's artillery were so heavy that it had to be immediately strengthened by drafts from Stevenson's force. His division was also too shattered by its losses to be able to make any pursuit, a duty which devolved on Stevenson.

The force defeated at Assye was composed of 16 regular battalions (10,500 men) trained by Europeans, and in a small measure officered by them, with over 100 well-equipped and well-served pieces of artillery, in addition to a large number of irregular infantry and cavalry, presumably about as useful on the battlefield as the British irregular allies. The comparative merits of the two armies may probably be judged by the respective strengths of their regular troops engaged in the battle, and there is no doubt that the enemy's artillery was first-rate. The baggage guard declared that the fire of the enemy's guns was maintained with a regularity and persistence resembling the firing of regular infantry.

On the 21st October the fortress of Asseerghur surrendered to Colonel Stevenson for a consideration. The British casualties were 2 killed and 6 wounded, and it is extraordinary that this occasion should have been commemorated by a special clasp in 1851, and the more so when it is remembered that in 1819 it stood a prolonged siege by the British who sustained heavy losses in reducing it. It is interesting to note that in 1851 several survivors of the Siege of Asseerghur in 1819, put in claims for the clasp for 1803.

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On the 22nd October the 1-3rd M.N.I. rejoined Wellesley, as he had sent to recall it three days after the battle of Assye; and the united forces of Wellesley and Stevenson came into contact with the diminished forces of the enemy on the plains of Argaum, 29th November, 1803.

The British troops engaged consisted of Wellesley's division that had fought at Assye, plus the 1-3rd M.N.I. which had been recalled since, and the whole of Stevenson's division as given above, including H.M. Scotch Brigade (94th Foot). (N.B.—There is some doubt as to whether the 5th Company, Bombay Artillery, was still with Wellesley's division).

The enemy were in line, infantry and guns in the centre, flanked by cavalry and light troops; the British were in two lines, infantry in front, and cavalry in echelon on the flanks.

The attack was delayed owing to two Native regiments of Wellesley's division, which had lost a large number of their British officers at Assye, falling into confusion early in the fight. This necessitated Wellesley rallying and re-forming them in person, which he effected most skilfully without hurting their *amour propre* by pretending to imagine that they had misunderstood their orders. H.M. 74th and 78th were attacked by a large body of "Persian" troops, who were destroyed entirely, and the 1-6th M.N.I. having repulsed Scindiah's cavalry on our left, the enemy's line was broken and retired in disorder, leaving 38 guns and all their ammunition in the victors' hands. The cavalry took up the pursuit till late at night.

Whether by accident or design, Lieut.-Colonel Orrok, the fire-eater of Assye, was with his regiment on baggage guard on this occasion. Colonel Stevenson, who was a most capable officer but in a bad state of health, commanded his division in action from the back of an elephant, an unusual mount for a British divisional commander.

The British casualties numbered 346, nearly one half being sustained by the few British corps; the 74th Foot having 52.

The combined British force marched at once to the siege of the fortress of Gawilghur, which was stormed on 15th December after a nine days' siege, during which the British casualties numbered 126. The troops engaged were the same units as those present at Argaum.

These successes, combined with those of Lake, broke up the confederacy, and compelled Scindiah and Berar to sue for peace, which was concluded early in 1804, and it will be remembered that Lake's campaign of 1804, which has been recounted before, was directed against Holkar, and later against Bhurtpoor.

Incomplete List of Engineer Officers engaged in the War.

Capt. Jno. Johnson, Bombay Engineers, Chief Engineer with Wellesley. Joined at Dharwar. Siege and Capture of Ahmednuggar, Battles of Assye and Argaum, Siege and Capture of Gawilghur, Chandore and Gaulna.

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Ensigns G. Rowley, Madras Engineers, commanded the Guides. Died 28. 6. 03, J. Blakiston, Madras Engineers, Siege and Capture of Ahmednuggar, Battles of Assye and Argaum, Siege and Capture of Gawilghur, Sam. Russell, Madras Engineers, with Hyderabad Subsidiary Force, Reduction of Asseerghur, Battle of Argaum, Siege and Capture of Gawilghur.

THE NEPAUL WAR, 1814-16.

The Nepaul War, occasioned by the encroachments and insolence of the Nepalese, consisted of two distinct phases, the first from October, 1814—May, 1815, and the second from December, 1815—March, 1816.

The first phase of the war was carried out by four divisions (and various detached forces), acting somewhat independently on an extremely extended frontier. They were as follows :—

3rd or N.W. Division :—Colonel D. Ochterlony in command.
2-1st, 2-6th, 1-19th and 6 Companies 2-19th Bengal N.I. (Colonel J. Arnold).
Artillery :—Detachment (Major A. McLeod).
Pioneers :—3rd and 4th Companies.
Cavalry :—2nd Bengal Cavalry, 1 rissala Skinner's Horse.
Reserve :—2-3rd Bengal N.I. and Light Battalion (formed from corps of the Division).
Reinforcements :—2-7th, detachment of 1-14th, and 1-15th Bengal N.I., Nusseeree Ghurkas and Sikh levy.
Original strength, 5,993 ; augmented to 7,112 ; irregulars, 4,463.

2nd Division :—Major-General R. Gillespie (killed at Kalunga 31. 10. 14). Colonel S. Mawbey (temporarily). Major-General G. Martindell (succeeded 20. 12. 14).
Detachment H.M. 8th Light Dragoons. H.M. 53rd Foot. Detachment Bengal Horse Artillery and Foot Artillery (Capt.-Lieut. W. Battine). 5th and 6th Companies Pioneers. 7th Bengal Cavalry, and 1 rissala Skinner's Horse. 1-6th, 1-17th and 4 Companies 2-19th Bengal N.I.
Reserve :—1-7th B.N.I. and Light Battn. (Light Companies of 1-6th, 1-7th, 1-17th, 2-16th, 2-26th, 1-1st, 1-5th and 1-27th B.N.I.).
Reinforcements :—1-13th, 4 Companies 1-27th, 2-26th, 2-27th and Light Company 1-26th B.N.I., also 10th B.N.I.
Original strength, 3,513 ; augmented to 10,422 ; irregulars, 6,688.

Benares Division.

Major-General J. S. Wood.

H.M. 17th Foot. Left Wings 1-14th and 2-14th B.N.I. and 2-17th B.N.I.
Artillery :—Capt.-Lieut. J. MacDowell, and later Capt. G. Pollock. 8th Company Pioneers. 8th Bengal Cavalry and 1 Troop 6th Bengal Cavalry.

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Reserve :—4 Companies 2-8th B.N.I., Grenadier Companies 1-17th and 2-17th B.N.I., 4 Companies 2-12th B.N.I.
Reinforcements :—Right Wing 1-14th B.N.I.
Original strength, 4,494 ; augmented to 4,698 ; irregulars, 900.

Dinapore Division.

Major-General B. Marley, succeeded by Major-General G. Wood.

H.M. 24th Foot.
1-8th, 1-18th, 2-15th, 2-25th and Left Wing 2-22nd B.N.I.
Ramgurh Battalion.
Detachment Chumparun L.I.
} Two brigades commanded by Lieut.-Colonel T. Chamberlain, 24th Foot, and Lieut.-Colonel G. Dick, 9th B.N.I.

Artillery :—Major G. Mason.
Pioneers :—1st, 2nd and 7th Companies (Capt. J. Swinton).
Gardner's Irregular Horse.
Reinforcements :—H.M. 14th and 17th Foot, and detachment Bengal European Regiment, 1-12th B.N.I., 2 Companies 1-25th and 4 Companies 1-9th B.N.I. Patna Provincial Battn., Chumparun L.I. Dromedary Corps.
Original strength, 7,989 ; augmented strength, 13,424.

Tirhoot Frontier.

Major P. Bradshaw.
Dets. Gardner's Horse, 2-5th, 2-15th B.N.I. and Chumparun L.I.

North Frontier, East of the Koosi.

Capt. B. Latter.
Rungpore and Patna Provincial Battalions ; detachments of 1-9th, 1-18th, 2-21st B.N.I. and of the Purnea Provincial Battalion.
Detachment Artillery.
Original strength, 2,218 ; augmented strength, 2,723.

Kumaon.

Colonel W. L. Gardner, succeeded by Colonel J. Nicolls.
1-4th, 2-4th, 2-5th and Grenadier Company of 2-27th B.N.I. Flank Battalion from the Dhun. Rohilcund Irregulars. Corps of Pathan or Mewatti Infantry.

The achievements of these various forces were as follows :—

Gillespie fell in a futile attack on Kalunga on 31st October, 1814 ; Colonel Mawbey who succeeded him made a second unsuccessful assault, sustaining even heavier losses than at the first ; but the fort was evacuated finally by the Ghurkas.

Major-General Martindell (who was appointed to the command vice Gillespie killed) carried out some very unsuccessful operations against the Fort of Jyetuck, and having sustained severe losses

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settled down to blockade the place, which was evacuated in 1815 on account of Ochterlony's successes elsewhere.

Major-General J. S. Wood made an unsuccessful attack on the post of Jeetpore, withdrew his forces, and contented himself with a passive defence and some futile demonstrations. His force returned to cantonments in May, 1815.

Major-General Marley's force lost two advanced posts held by detachments, which were attacked and defeated with heavy loss. These disasters unnerved General Marley to such an extent that, despite strong reinforcements, which included two King's regiments, he *deserted his division* early on February 10th, 1815, without warning or handing over. Colonel G. Dick assumed command at this crisis, until the arrival of Major-General G. Wood from Calcutta. General G. Wood proved as inactive as other commanders and effected nothing.

Ochterlony began his operations in November, 1814, and directing them against Nalaghur, Ramghur, and Mallown, with skill and decision, took the enemy's positions one by one, until the principal position at Mallown fell on 11th May, 1815; this led to the fall of Jyetuck as mentioned above. His division was the only one handled with skill, and which achieved its object, and for his valuable services he received deservedly the K.C.B. and was created a baronet.

The minor operations conducted by Latter, Bradshaw, and Nicolls were generally successful, and Nicolls captured Almora. The Nepalese Government then entered into negotiations, which lasted many months, but towards the end of the year it was discovered that they did not intend to ratify the treaty that had been agreed upon. This led to the second phase of the war, and Sir D. Ochterlony was directed to resume military operations and was placed in chief command of the invading force.

2nd Phase.—December, 1815—*March*, 1816. *Major-General Sir D. Ochterlony in Command.*

Right Column :—Colonel W. Kelly, 24th Foot.

1st Brigade :—H.M. 24th Foot. 1-18th and Right Wing of 1-21st and Left Wing of 2-21st B.N.I. Chumparun Light Infantry. Strength 4,200.

Centre Column :—Sir D. Ochterlony.

3rd Brigade :—Lieut.-Colonel F. Miller, 87th Foot. H.M. 87th Foot. 2-12th, 2-22nd, and 2-25th B.N.I.

4th Brigade :—Col. G. Dick, succeeded by Lt.-Col. J. Burnett. 2-4th, 2-8th, 2-9th, 2-15th and Right Wing of 1-30th B.N.I. Strength 7,843.

Left Column :—Lieut.-Colonel C. Nicoll, 66th Foot.

2nd Brigade :—H.M. 66th Foot. 5th and 8th Grenadier Battalions B.N.I. 1-8th and 2-18th B.N.I. Strength, 4,280.

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Attached to the main army and distributed amongst the brigades :—
Artillery, Engineers, 2 Companies Pioneers, and 5 rissalas of the 1st Rohilla Cavalry. Strength 3,070.

Colonel J. Nicoll's Division :—Seetapore and Kumaon.

Artillery, Engineers and 6th Company Pioneers.
Wing of H.M. 67th Foot. 2-10th, 1-22nd, 1-25th and 4th Grenadier Battn. B.N.I. Light Companies 1-1st, 1-2nd, 2-2nd, 1-11th, 1-15th and 2-24th B.N.I.
2nd Rohilla Cavalry (6 rissalas).
Detachment Sirmoor Battn. and half 72nd Experimental Dromedary Corps. Strength 6,617.

Major-General J. S. Wood's Division :—Goruckpore Frontier.

Artillery.
H.M. 17th Foot. Detachments 1-14th and 2-14th B.N.I., 2-17th B.N.I. Detachment Mirzapore Battn. Goruckpore Hill Corps, and Gardner's Horse (2 rissalas). Strength 4,866.
Additions :—2-8th, 2-12th, 5th Grenadier Battn. and detachment 2-17th B.N.I. Detachments Mirzapore Battn. Goruckpore Hill Corps and Artillery. Strength 5,143.

Tityala.

Capt. B. Latter.

Artillery.
Detachments 1-9th, 1-30th and 2-30th B.N.I. and Rungpore Battn. Strength 2,489.

The campaign was short, sharp and decisive. Sir D. Ochterlony advancing in February with the centre column, turned the enemy's position at the Chiriagati Pass, by a difficult and brilliant flank march, defeated them with heavy loss, and occupied Muckwanpore.

The right and left columns also advanced, but only the right column experienced any serious fighting in the capture of Fort Hariharpur. The British successes led to another treaty being drawn up, and this time signed, by which the Nepaul Government ceded even more territory than had been demanded in the first treaty. For these brilliant services Ochterlony received the G.C.B., the first officer of the Indian Army to be thus honoured. The company's medal for the war was given in silver to all Native officers and to such Native non-commissioned officers and men who were recommended for the distinction, who had actually served in the hills.

In 1851 the Army of India Medal and clasp " Nepaul " was granted to all survivors, European and Natives (other than those Natives who had received the Company's medal), who had served *in the field*. This excluded certain troops from the grant, and the European

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regiments thus excluded were the 14th Foot and the detachment of the Bengal European Regiment, who formed part of the reinforcements ordered up to strengthen the Dinapore (Major-General Marley's) Division in January, 1815.

The British regiments that received the medal and clasp were

Detachment 8th Light Dragoons,

H.M. 17th Foot, 24th Foot, 53rd Foot, 66th Foot, one wing of the 67th Foot, and the 87th Foot,

of whom the 17th and 24th Foot alone served in both phases of the war; while the 87th Foot took a conspicuous part in the brilliant operations that brought it to a successful conclusion.

An Incomplete List of Officers of the Bengal Engineers who served in the War.

Captains H. W. Carmichael Smith. (With Colonel Mawbey's Column, 1814–15). R. Tickell. R. Smith.

Lieuts. E. Garstin. (1814–15 Campaign). P. Lawtie. (With Ochterlony's division. Died from fatigue 4. 5. 15. A most distinguished junior officer). W. E. Morrison. (With Major-General J. S. Wood's division. Died of wounds 6. 1. 15).

Ensign G. Hutchinson.

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REVIEWS.

AUTOMATIC FIREARMS.

By CAPT. CORDIER.

A VERY useful publication for anyone who wishes to study in a condensed form the latest ideas—whether these have yet taken practical shape or not—as to the construction of automatic firearms. The details are clearly described and are accompanied by numerous diagrams. All classes of weapons are dealt with, pistols, rifles, repeating rifles, machine guns, and repeating guns, and the greater or less degree of automatism, called for by considerations of the tactical employment of each weapon, is fairly fully discussed. Descriptions are given of various methods of obtaining the necessary motive power from the discharge of the cartridge, trigger systems, methods of opening and closing the breech, extraction, ejection, safety appliances, repetition, rapidity of fire, cooling the barrel, etc. The present position of the question, and the difficulties still to be overcome are touched upon in the last chapter.

A.R.R.

FIELD ENGINEERS HANDBOOK.

WELLS AND CLAY.—(Publishers: Edward Arnold, London).

THE authors while acknowledging the existence of many excellent treatises on surveying, consider them quite unsuitable as handbooks for Civil Engineers. In an endeavour to supply this want this handbook has been compiled. It is compact and of a convenient size to be carried in the pocket.

Chapter I. deals with the Use and Adjustments of Instruments.
,, II. Chain Survey.
,, III. Levelling.
,, IV. Traverses.
,, V. to IX. Curves, Railway Survey, Location and Construction (North American Practice).
,, X. Tacheometry.
,, XI. to XIV. Astronomy—Determination of Azimuth—Time and Latitude.

Appendix I. The General System of Land Survey in Canada.
,, II. Latitude Formulæ.
,, III. Spherical Trigonometry.

There are also tables giving curves and their radii, tangent distances, etc. The book contains a good deal of useful information, especially with regard to railway surveying, location and construction.

E.F.D.

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ILL-TRAINED AND ILL-PAID OFFICERS.

RECENT articles in the *Journal des Sciences Militaires* have criticized certain French Army customs. The author of this pamphlet supplies, as a contribution to the discussion of the subject, a review of an article by Mr. Howard Hensman, which was published in *Pearson's Magazine* for May, 1912, under the above title. He also gives certain extracts from the *Journal of the Royal United Service Institution* of April, May, and June, 1911, on the subject of Military Education. With regard to the criticisms levelled in the latter publication against the Territorial officer, the author of the review asks whether these are specially applicable to the English Territorial officer, or whether they are not equally applicable to the French officer. His final remarks on the article in *Pearson's Magazine* are that the suggested remedies are formulated somewhat vaguely, and that every army must be desirous of similar reforms. He considers that the interest of the article lies in the cruel precision with which the author lays bare the faults which the English officer has to contend with. Even if the author may have drawn too highly coloured a picture, with a view to striking public opinion, he must be congratulated on his evident sincerity. This gives promise of an amelioration which may be realized quickly, and, in the opinion of all those who study the progress of the British Army, will quickly place it on a level with the best.

A.R.R.

INSTRUCTION MÉTHODIQUE DES CADRES ET ÉLÈVES-CAPORAUX (THE METHODICAL INSTRUCTION OF CADRES AND ASPIRANT CORPORALS).

By LIEUT. BIETRON.—(8vo. 71 pp. Paris, 1912. *Chapelot.* 1s. 3d.).

IN the French Army, as soon as the yearly contingent of recruits has settled down and the officers have learned something about them, the best men are picked out and, in addition to the ordinary instruction of their class, are given a special course in order to fit them to be corporals. This course is both theoretical and practical, and it may be carried out either by the company or the battalion as convenient. The individual instruction of the men is perfected, they are trained to command and correct faults and generally to act as non-commissioned officers.

The author's aim in his pamphlet, in view of the very scanty contents of the training manuals which deal only in generalities and leave all initiative in the matter to the officers concerned, is to present a few ideas and indicate some methods by which the work of the instructors will be lightened.

"E."

LES ARMÉES DES PRINCIPALES PUISSANCES AU PRINTEMPS DE 1913.

(8vo. Pp. 465. Paris, 1913. *Chapelot*).

THIS annual contains an accurate and convenient summary of the statistics relative to the 38 principal armies of the world, including those of Afghanistan and Abyssinia. Thirty-one pages are devoted to Great

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Britain and its dependencies. The general headings dealt with are budget, recruiting and effective commons and administration, *personnel*, staffs and departments, troops, higher units, instructional establishments, remounts, *matériel*, armament, supply, transport, clothing and equipment.

Apart from its value as a book of reference, it is useful as giving the correct translation of a number of military phrases, *e.g.* :—Warrant officer is *adjutant*; field confrère *compagnie montée*; signal company, *compagnie de signaleurs*.

"E."

MAPS AND SURVEY.

By A. R. HINKS, M.A.

IN his preface Mr. Hinks states that experience in teaching has shown him the need there is of a book, which will give a general account of the many-sided art of survey, and be a supplement to the present *Text Book of Topographical Surveying* and the *Manual of Map Reading and Field Sketching*, and as such his *Maps and Survey* is of very great use. In Chapter I. he clearly shows the waste there is in making surveys for special purposes in a country which has not been mapped, and the necessity for its survey at as early a date as possible. The chapter on map analysis contains valuable information which otherwise could only be obtained by reference to a large number of official publications, etc. In perusing it, the student has placed before him the various systems of mapping adopted by the Ordnance Survey of Great Britain, as well as by Foreign Governments. The only fault to be found (a small one which can be remedied in the next edition) is that the illustrations are, in a good many cases, bound several pages away from the letterpress. This is especially noticeable in *Plate* XX. which faces p. 150 and is referred to on p.194 and in *Plate* XXII. facing p. 176 and referred to on pp. 184 and 200. The Plane Table and Sight Rule illustrated on *Plate* XV. and called the "School of Military Engineering" pattern is the "Service" pattern.

NEW CONTOUR MAP OF THE NEAR AND MIDDLE EAST.

(E. W. Bacon, 127, Strand, W.C. 7s. 6d.).

THE above is a new map, 40″×30″. It gives a graphic delineation of the entire Middle East contained between Lat. 50 and 10 S., from the Balkan Peninsula, Sicily, and Tunis in the West to the Pamir Plateau, Peshawar, and Karachi in the East. The map is on the scale of 1:6,019,200, or 95·6 miles to 1 inch, with an inset of Palestine on the scale of 1:685,000. Heights and depths are depicted by means of colours, and the various journeys of St. Paul, Alexander, and Pompey are clearly indicated. Both ancient and modern names of places are shown. It is sold in styles suitable for the wall or for folding.

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NOTICE OF MAGAZINE.

RIVISTA DI ARTIGLIERIA E GENIO.

March, 1913.

THE ENGINEERS OF THE FRENCH ARMY.

(*A*). *Peace Organization.*

The engineer arm comprises the engineer troops and a special staff. The latter in peace time is formed of a *personnel* that provides for the engineer service in France, in Algeria, in Tunis, and in the Colonies and which in time of war forms part of the united mobilization.

The engineer troops comprise :—

1st.—The sapper field companies for fortification works and bridging; the construction and maintenance of roads; the destruction and repairs of ways of communication, and also for the attack and defence of fortresses.

2nd.—Fortress sapper and miner companies which are specially intended for work on permanent fortifications, and for the defence of strong places.

3rd.—Railway companies for working the railways, for the construction of new trunk lines, and for railway service in the zone near the enemy.

4th.—Telegraph companies for telegraphic communication in the advanced zone.

5th.—Detachments of sapper pigeon-post for the employment of trained pigeons between forts and the country, and for communicating with cavalry.

6th.—Detachments of "Alpine sappers" specially intended for mountain work and attached to the Alpine troops.

7th.—Companies of "transport sappers" for the transport trains which carry the necessary engineer material for the troops, the bridging equipment, and the engineer parts.

A statement of the number of special detachments and their actual composition is also given in the Journal. A note in this statement refers to a new order that will modify the present organization and which will be discussed in Parliament. While at present the engineer field companies are distinct in divisional companies (46) and army corps (19), the new proposal tends to suppress the army corps companies, and to increase the divisional companies which would be available at the time of mobilization.

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Aeronautical Observers.

The *France Militaire* states that the War Minister, in a circular of the 28th February, has issued the regulations for the courses of instruction of aeronautical observers for the present year.

Instruction in observing from aeroplanes is given (1) to officers with brevets from the war school, who have completed their observation course during the last year; (2) to officers of the staff who have not yet received instruction; and (3) to a certain number of cavalry lieutenants who have not obtained the brevet.

The instruction for officers of the staff as observers from balloons will comprise: (*a*) practical aeronautical reconnaissances; (*b*) ascents in free spherical balloons; (*c*) ascents in dirigibles for officers who have the simple aeronautical brevet.

Applications from officers who desire to enter for these courses, with the necessary medical certificates and recommendations from their superiors, should be submitted to the Minister. The circular also lays special stress on the importance of the greatest possible number of officers with brevets, receiving instruction as observers.

Personal Navigation for Military Aviation.—The *Bulletin Officiel* of the 10th March states that commanders of army corps, should transmit to the permanent inspector of military aeronautics by the 25th of March, applications from officers and men of the troops who wish to receive instruction as aviation pilots in 1913.

Officers must have completed two years' active regimental service, and the application must be accompanied by a medical certificate of physical ability and of their weight; there must also be a note of their proficiency in physical exercises, of their knowledge of mechanics, and of their aptitude for a short course in radiotelegraphy. All superior officers who have to submit these certificates upon the qualities of the candidates, should at the same time report upon their zeal in the service, their character, and their degree of nervousness, and impressionability.

The requirements for the men are :—

(*a*). For under officers, two years' service, age below 30 years, and an engagement to remain in the army two and a-half years after the date of being appointed to the aviation service.

(*b*). For corporals and privates, six months' service, and an engagement to remain in the army for two and a-half years from the date of being appointed to the aviation service. Those who have the brevet of military aviator have only a compulsory service of 18 months. The appointments will be made by the Minister, to whom the permanent inspector of aeronautics will submit the applications with his opinions.

Switzerland.

Mountain Artillery.—In accordance with the new orders, the number of mountain batteries are to be increased from six to nine,—comprised in four groups. The three new batteries are, under orders from the military department dated the 13th February, to be raised in the ensuing spring. The groups will then be as follows :—1st group—1st and 2nd mountain batteries; 2nd group—3rd and 7th mountain batteries;

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3rd group—4th and 8th mountain batteries; 4th group—5th, 6th, and 9th mountain batteries.

These batteries are stationed for mobilization and instruction as follows:—1st group at Sion, 2nd group at Brieg, 3rd group at Seewen, and the 4th group, with the exception of the 5th battery, at Bevens, 5th battery at Thusis.

Special courses of instruction for each group successively will be held near Thun until the 21st of April, so as to allow for the constitution of the new batteries. Each of the four groups of mountain artillery is attached to one of the four mountain infantry brigades.

April, 1913.

RECONNAISSANCE WITH AEROPLANES IN FIELD WARFARE.

The *Militär-Wochenblatt* of the 29th March publishes an article with the above title, in which the importance of the subject is fully and ably treated. The service of aviation constitutes one of the finest pages of the recent campaign in Libia. This new means of warfare was employed here for the first time on a large scale and showed its usefulness. This was most creditable seeing how short a time has elapsed since the aeroplane has become an efficacious means of exploration for the commander of troops.

It was held at first that the management of the aeroplane and the reconnaissance should be concentrated in the same person. France especially gave the preference to light and rapid aeroplanes carrying only one person, and possessed a large number of officers of the general staff with the brevet of pilot. The need for flying high so as to escape the fire of artillery and rifles, in addition to the increased skill and vigilance required by the pilots, soon showed the necessity for a special observer. The simplest method would seem to be to select the observers from the pilots. With two pilots in an aeroplane a change of duties between the pilot and the observer would be rendered possible in long and fatiguing runs. In any case it is obvious that the observer should possess a certain fund of technical knowledge. He should, in particular, be acquainted with the mechanism of the motor, and should be able to give competent assistance to the pilot. The observer seated in the aeroplane should trust implicitly in the pilot, and the latter on the other hand, by his guidance of the machine, should work in conjunction with the observer.

The observer's duties are, (1) direction and reconnaissance, (2) throwing of projectiles, and (3) the use of defensive weapons. He should also possess a certain practical knowledge of the management of photographic apparatus, of optical signalling apparatus, and of telegraphy.

To the uninstructed the direction of the aeroplane would seem to be a simple affair. In calm weather it certainly is not difficult to fix the route by means of the map. The network of the ordinary roads and railways, the rivers and lakes, the localities and the woods supply valuable references. On the other hand, the inequality of the ground in comparatively flat districts cannot be recognized from great heights. But directing an aeroplane in a voyage through clouds, rain and mist

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is a very different matter. In long distances traversed in very few minutes and with the wind in rear, the number of kilometres is double the number of minutes. If the observer, owing to atmospheric changes, should not be able to see clearly, and loses even for a short time his orientation, it is most difficult to find his position when he can again see the country over which he is passing. The observer should be able to see well, to take in rapidly what he sees, to judge the ground correctly and should be well practised in reading maps.

Observation is difficult over ground which is much intersected by roads, but which is deficient in rivers, water courses, or woods. The observer may easily be mistaken in a road over which he has to pass on his aeroplane, when the locality is devoid of characteristic signs recognizable from a height.

It is only with intense attention that an observer can know his direction with exactness. The pilot of the aeroplane, even in the normal conditions of peace, is not too pleased at having to come down owing to the observer missing his direction ; in war, alighting on the field of operations of the enemy would of course mean the loss of the aeroplane.

The duties of the observer differ considerably, and depend on whether the aeroplane is proceeding on strategical reconnaissance, a tactical one, or is subsidiary to the artillery. The strategical reconnaissances are the most important as they compel the aeroplane to fly beyond the field of the enemy's operations. The discovery of the enemy's flanks and of the columns of the supports and reserves are of vital importance. In all cases, the observer must not only see, but must also be able to judge what he has seen. The commander of troops not only wants to learn from the observer that a column is marching on a road, but also to ascertain its strength. A column on the march can be easily discovered in fine weather, but not when the weather is cloudy or rainy. Only a trained and quick eye and a knowledge of the formations of troops can give to the observer an exact idea of what he has seen. It is not easy to recognize the number of the battalions, or to distinguish the mitrailleuses, or the light from the heavy guns, and the difficulty is increased by the dust from the roads. The observer should know the tactical situation exactly, so as to be able to judge on what roads there are likely to be troops on the march, and those on which convoys of parks or other carriages would be moving.

Reconnaissance on the battlefield imposes great stress upon the observer. The field of view is limited, and the discovery of small detachments of troops is so difficult that only an observer endowed with a sound tactical intuition can arrive at a satisfactory conclusion. The battle tactics of various armies and of the different arms, the manœuvring of great units in attack and defence, the rules for the formation of the reserves, should all be familiar to the observer.

Reconnaissances to discover an enemy's artillery require a knowledge of the principles on which the selection of relative positions are based. With a well-conducted reconnaissance of masked artillery, an observer can render valuable service to the commander of the troops.

Reconnaissance and observation by means of the aeroplane will in the future become very useful, especially for artillery. While in the

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past it was necessary to expend much ammunition to counteract the enemy's artillery, the position of which was not known, now, by the aid of aeroplane reconnaissances, the position of the masked batteries can be rapidly ascertained under favourable circumstances.

Aeroplane observations of the shots directed on a target, and the transmission by visual signalling of the results, limit the dispersion of fire in a marked degree. But only a trained eye can succeed in noting from a great height the bursting of the shells and the places struck by the shot. In fact only complete instruction in peace time can prepare for a campaign.

Trials have shown that rifle bullets, or chance shrapnel bullets have not caused important damage to an aeroplane, provided that the pilot or the more delicate parts of the machine are not struck. To escape the fire, the aeroplane should rise to as great a height as possible without exceeding the limit from which observations can be made; a limit depending upon the sight and aptitude of the observer. The trials of last year have shown that aeroplanes provided with good apparatus for aiming and throwing bombs, can strike targets covering about the same area as masses of troops in railway stations, on roads, or in the open country.

The services of the observer in an aeroplane have not yet been sufficiently appreciated, the general attention being always fixed upon the pilot to whom all the credit is given. But the success of a voyage of reconnaissance in an aeroplane depends entirely upon the co-operation of the pilot and the observer.

GERMANY.

Conditions required from the Manufactories of Aeroplanes for Military Purposes.—The following conditions laid down by the Inspector of German Military Aerial Navigation for the construction of aeroplanes acquired for military purposes, are taken from the *Militär Zeitung* of the 15th February.

1st.—The aeroplanes must be constructed by German labour and with German material.

2nd.—The aeroplane is to be provided with seats for the pilot and the observer. The seats are to be placed so that the pilot and the observer can communicate easily with one another.

3rd.—The pilot and the observer should be protected as much as possible from the wind, and should have free movement of the arms. The car should have sufficient space for a bomb-throwing apparatus, and for the projectiles, and should permit of free photography.

4th.—It is of great importance that the aeroplane should have automatic stability, and that the working parts should be under easy control.

5th.—The apparatus which conforms to the conditions of military pilotage should have the preference.

6th.—Care should be taken for a good arrangement for the various instruments required for navigation (barometers, compass, timekeeper, etc.). It should be possible during a flight to verify the expenditure of benzine and lubricants.

7th.—The velocity of the aeroplane should be about 90 k.m. per hour.

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From such velocity or greater it should be able to descend at 75 k.m. per hour without interfering with the horizontal flight.

8th.—With a view to facility of repairs the dimensions of the aeroplane should be contained within the following maximum limits :— width 15·50 m., length 12 m., height 3·50 m.

9th.—The aeroplane should carry enough petrol for a flight of four hours.

10th.—The motor should not exceed 100 H.P. In equally efficient aeroplanes, the preference will be given to the motor with the lesser power.

11th.—The petrol should be stored in the least dangerous position. The tanks should not be placed either above or below the people in the aeroplane.

12th.—The aeroplane to be provided with apparatus for the march.

13th.—The propeller of the motor should not be at less than 45 c.m. from the ground.

14th.—The aeroplane should be able to ascend 800 m. in 15 minutes.

15th.—On level ground the aeroplane should be able to take flight in a distance not greater than 100 m., and to stop after alighting in not more than 70 m. It should also be furnished with apparatus for changing its direction on the ground.

16th.—Taking flight and alighting should be exhibited at the military aviation ground at Döberitz.

17th.—The aeroplane should be capable of carrying about 200 k.g., including the pilot and observer, but not the petrol, the tools, or the instruments.

18th.—At the trials, the aeroplane should descend with free flight and with shut-off motor from a height of 500 m., and should be able to turn to the right or left.

19th.—The aeroplane should be put together or dismantled with ease and readiness ; five men should take two hours for the mounting and one hour for dismantling. It should be capable of being loaded on a railway and on ordinary wagons and its shape should be limited to the dimensions allowed for railway transport and for ordinary roads.

20th.—The aeroplane should not be affected by changes of temperature.

21st.—The different parts of the aeroplane should be easily interchangeable.

22nd.—The motor should be provided with a silencer.

Attainment of great velocity is not considered of very much importance and it is not thought necessary to exceed 90 k.m. per hour. But it is thought necessary to increase the velocity of ascension which is now laid down at 800 m. in 15 minutes instead of 500 metres as hitherto.

E. T. THACKERAY.

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RECENT PUBLICATIONS OF MILITARY INTEREST.

REVIEW OF BOOKS.

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HISTORY.

THE SIEGE OF PORT ARTHUR. ITS TACTICAL LESSONS. (Le Siège de Port Arthur. Enseignements Tactiques). By Commandant A. H. 182 pp., 3 maps at end. 8vo. Paris, 1912. L. Fournier. 3s. 4d.

This book deserves the favourable reception which the Continental Military Press has accorded it. It consists of twelve chapters, of which the last is devoted entirely to comments. The narrative chapters, which also contain observations, are clear, concise, and, generally speaking, very accurate; pp. 1 to 12 give a topographical description of the town and its environs; p. 14 shows the state of the principal defences on the outbreak of war. On p. 25 is given the distribution of the defenders along sections of the defensive perimeter, and attention is called to the extensive breaking up of larger units which took place. The author is mistaken (pp. 52 and 54) in ascribing the failure of the Japanese night attacks during the August general assault to searchlights; it was rockets and star shells that produced the effects named along the north-eastern sector of the defences. The author states (p. 67) that the Japanese had emplaced six 11-in. howitzers by September 18. The first round from these pieces was fired by the Japanese on October 1.*

In Chapter VI. (p. 71 et seq.) and elsewhere, when referring to the operations there described, the assaults on the advanced positions about Shui-shih-Ying and the first attack on the 203-Metre Height are placed in the period October 19 to 23, whereas they took place during the corresponding days in September.† From p. 98 it might be inferred that the night attack (November 26 to 27) on Sung-shu Supporting Battery by Nakamura's forlorn hope was part of the original plan for the assault on the north-eastern sector (November 26), whereas it was determined on, only after the failure of the preceding day's frontal attacks against this sector, with the object of turning one flank.

Minor errors are: (General) "Matsumaru" for "Matsumura" (p. 74); (Lieutenant-Colonel) "Okouno" for "Okubo" (p. 102).

The following are noteworthy extracts from the last chapter (Lessons):—

> "Although well informed concerning the Russian defences the Japanese had not realized the solid nature of the provisional works constructed by their adversaries. However well informed an attacker may be beforehand, a reconnaissance at the last moment is necessary in order to ascertain the exact condition of the defences. It is impossible to base a plan of attack entirely on data obtained in peace. The ignorance on the part of the Japanese of the depth of ditches and state of accessory defences, as well as their erroneous anticipations as regards the effect of artillery fire on the works were the cause of heavy losses and initial checks."

As regards artillery, the author holds that the siege proved the need of light indirect fire pieces on the defender's side, in order to reach attacking infantry in dead ground just in front of the works. He states that Krupp is constructing a gun of this nature. Of heavy artillery, he says that it must be mobile, not only with a view to attaining

* See *The Official History (Naval and Military) of the Russo-Japanese War*, Vol. II., p. 547.

† See *The Official History (Naval and Military) of the Russo-Japanese War*, Vol. II., pp. 524—542.

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concentrated effect, but also in order to escape damage. "Long range cannot always compensate for mobility; instead of concentrating pieces, relatively safe positions should be sought for them whence enfilade and oblique fire can be brought to bear." On p. 114, when describing the October (*sic*) attacks on the 203-Metre Hill and neighbouring heights (which actually took place September 20 to 23), he quotes an instance where Japanese artillery fire drove out of a position its own infantry which had effected a lodgment. The enemy thereupon re-occupied the position. On p. 170 he refers to this incident and says that it would not have occurred if telephone communication had been established more promptly.

For machine guns in siege warfare he recommends shields; he dwells on the importance of at once placing some machine guns in freshly captured positions; but thinks that for destroying sapheads, etc., they are insufficient unless supplemented by light guns.

He points out that for 3 divisions of 2 brigades each, plus 2 independent brigades, the Japanese had 9, and later 14 engineer companies. According to him engineer units were always kept up to strength by drawing at once on infantry units to replace losses. He then proceeds:—

> "However numerous engineers may be, they cannot perform all the duties usually allotted to their arm. Infantry must execute the bulk of these, under skilled supervision if necessary. Engineers must be used for special and difficult tasks such as mining, constructing and demolishing obstacles, preparations for crossing ditches, making breaches."

Those who think that most field engineering tasks are beyond the capacity and outside the scope of infantry, and who hold that this arm should construct only simple trenches, should bear this lesson in mind.

On p. 84 attention is called to the way in which captured positions were *immediately* put in a state of defence. Elsewhere he says:—

> "Infantry should be as well trained in the use of pick and shovel as in that of rifle and bayonet."

Of cover he says that shelters with light head cover, situated on reverse slopes, can only be damaged by artillery after a long time and at the expense of much ammunition; that, on the other hand, parapets of ordinary fire trenches, within view of attacking guns, are always demolished in the end by artillery projectiles, which, moreover, sweep the trenches. "Enfilade and high angle fire, and also high explosive projectiles brought about the use by both sides of narrow deeply-sunk trenches, with traverses only 15 to 20 ft. apart. This type is now regulation in Russia and Germany." The statement (p. 147) that wire entanglements, of barbed wire where possible, were very extensively constructed is somewhat misleading; actually, owing to lack of material, barbed wire was very little used.

When dealing with infantry tactics he relates how at certain spots, where the opposing troops were very close to each other, the Russians were warned of an impending attack by hearing bayonets fixed. He adds that the necessity of training infantry in the use of the bayonet is one of the chief lessons of the siege "and one not lost upon the Germans."

The following observations on the taking of colours into action echo the impressions of all those who witnessed the fighting in Manchuria:—

> "It is necessary to call attention to the use which the Japanese made of colours* planted on positions captured or on the point of being taken, in order to warn artillery to lengthen its range. Moreover, the sight of the colour had a considerable moral effect on neighbouring troops; *e.g.*, attack on East Panlung, August 22."

Page 175 gives percentages of shell, bullet, and bayonet wounds on the Japanese side.

* It is not clear from this quotation whether the author refers to the regimental colours or to the numerous flags having a red "rising sun" on a white background which Japanese units carried with them.

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Of the three maps, Nos. 1 and 2 show the ground, the former east of the River Lunho and the Mandarin Road, the latter west thereof. No. 3 shows the organization (fighting front, parks, communications, etc.) of each army.

These maps—clear and accurate as the text—would puzzle many owing to the nomenclature employed. In order to remedy this difficulty, which is common to all works on the Russo-Japanese War, the author has added an annexure showing various renderings, Russian, Chinese, etc., of place names.

This list, as amended and amplified to adapt it to the requirements of British readers, is reproduced below :—

Literal Translation of or Actual French Rendering in Book.	*Russian Rendering.*	*Name or Names used in British Official History of the Russo-Japanese War, Part III.*	*Japanese Rendering (frequently used in British Attachés' Reports).*
Golden Hill ..	Zolotaya Gora ..	Golden Hill ..	Ogonzan.
Montagne de la Croix	..	Not given. Height South of Fort Pai-yin on which No. 21 Work stands	
Fort No. I.	As in French ..	Fort Pai-yin ..	Hakuginzan. (Lit. "White Silver Hill"). Not Hakougiou Chan, as given in French work.
Grande Montagne ..	Bolshaya Gora ..	Height 686 (ft.) ..	..
Ouvrage No. 2 ..	As in French ..	Chikuan South-East	Higashi Keikwanzan Tonan or To Keikwanzan To Nan. Not Tanki-Kouanchan, as given in French book.
Batterie B	As in French ..	Chikuan Battery ..	..
Batterie derrière B	Zaliternaya ..	Not named ..	"R" Work.
Lunette Kouropatkine	..	Not named. Between Chikuan Battery and Fort Chikuan	"Q" Work.
Petit Nid d'Aigle (Small Eagle's Nest)	Maloe Orlinovoe Gnyezdo	Not named ..	"M" and "N" Works.
Grand Nid d'Aigle (Big Eagle's Nest)	Bolshoe Orlinovoe Gnyezdo	Wangtai. (The Chinese rendering)	Bodai. (Not Vangtai, as given in French Work).
Montagne sans Nom (Nameless Hill)	Bezimyannaya Gora	Not given. An entrenched ridge N. of Naval Ridge	..
Crête Marine ..	Morskoi Kryaj ..	Naval Ridge ..	..
Fort No. II. ..	Same description as French	Fort Chikuan ..	Chikuan North Fort
Caponnière No. 2 ..	Same description as French	..	"P" Work or Fort Ichinohe.
Redoute No. 1 ..	Ditto	East Panlung ..	Banriusan. (The
Redoute No. 2 ..	Ditto	West Panlung ..	Japanese equivalent of Panlung).
Caponnière No. 3 ..	Ditto	..	"G" Work or Hachimakiyama.
Batterie derrière, Les Redoutes	Zaredutnaya ..	..	"H" Work.
Batterie de Mortiers du Loup	Volchya Mortirnaya	..	"I" Battery.
Mont Mitrophane	Mitrofanskaya Gora	Not given. N.W. of Naval Ridge and S. of Fort Erhlung	..

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Literal Translation of or Actual French Rendering in Book.	*Russian Rendering.*	*Name or Names used in British Official History of the Russo-Japanese War, Part III.*	*Japanese Rendering (frequently used in British Attachés' Reports).*
Fort No. III. ..	Same description as French	Fort Erhlung ..	Niriusan. (Erlounchan, given in the French Work, is the Chinese equivalent).
Crête Rocheuse ..	Skalisti Kryaj ..	Not given. Height immediately S. of Fort Sung-shu	..
Ouvrage No. 3. (No. 3 Work)	Same description as French	Fort Sung-shu ..	Shojusan.
Batterie du Tertre. (Battery on the Hillock)	Kurgannaya Batarea	Sung-shu, Supporting Battery	Shojusan, New Battery.
Redoute de l'Aqueduc, or Redoute Kouropatkine	Vodoprovodni Redut	Waterworks Redoubt	Fort Kuropatkine, or the Red Redoubt.
Redoute Rocheuse	Skalisti Redut	..	Referred to as "Fort S. of Lunyen." Japanese name for Lunyen is Riugan.
Redoute de la Pagode	Kumirnski Redut	Temple Redoubts A.B.C.D. ("B" is the Work meant)	Referred to as Lunettes S. of Suisiei A.B. (the one meant) C.D.
Chouichiin	..	Shui-shih-ying ..	Suisiei.
Montagne der Loup (Wolf Hill)	..	Feng-huang-shan	Hozan.
Vantaichan (p. 36)	..	Kantashan	Udaizan.
Tchanlinsa (Map 3)	..	Chang-ling-tzu	Choreishi.
Panlounchan ..	..	Heights 305 and 331 (ft.) S.W. and W. of Shui Shih Ying.	Heights 93 and 101 (metres) S.W. and W. of Suisiei.
Montagne de l'Angle (marked 183 metres), *i.e.*, Angle Hill	Uglobaya Gora	174-Metre Hill (thus described also by Attachés)	..
Montagne Longue	Dlinnaya Gora	Namako Yama	Namako Yama.
Montagne de la Division	Divisionnaya Gora	Division Hill ..	Called the Rocky Ridge or Horseshoe Spur in Attachés' Reports.
Montagne Plate (Flat Hill)	Ploskaya Gora ..	Akasakayama ..	Akasakayama.
Montagne Haute (High Hill)	Visokaya Gora ..	203-Metre Hill ..	Nireisan (means two nought three) Royosan or Height 691 (ft.).
Montagne Fausse (False Hill)	Falshvoaya Gora	No name given. Ring Contour S. of 203-Metre Hill	..
Fort No. IV. ..	Same description as French	Fort I-tzu-shan ..	Isuzan.
Ouvrage No. 4 ..	Ditto	Fort An-tzu-shan	Anshizan.
Batterie G	Ditto	An-tzu-shan East	..
Fort No. V. ..	Ditto	Ta-yang-kou North Fort	Nishi Taiyoko.
Batterie D	Ditto	Ta-yang-kou South	Minami Taiyoko.
Ouvrage No. 5 ..	Ditto	Fort Chakuatzu ..	Fort Kokoshi.

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BOOKS RECEIVED.

LES ARMÉES DES PRINCIPALES PUISSANCES AU PRINTEMPS DE 1913. La librairie Chapelot vient de publier l'édition annuelle de son ouvrage. Prix, 4 fr.

APERÇU DE LA CAMPAGNE DE THRACE. Colonel Desbrière. Paris. 1913. Chapelot. 1 broch. in-8, 54 p., avec 5 croquis. 1 fr. 25.

INDIAN RECORD SERIES: VESTIGES OF OLD MADRAS, 1640—1800. Traced from the East India Company's Records preserved at Fort St. George and the India Office, and from other sources by Henry Davison Love, late Lieut.-Colonel, Royal Engineers, and Brevet Colonel, Hon. Fellow of the University of Madras. 3 vols. and an index. With maps and illustrations. 1913. 36s. net. John Murray, Albemarle Street, London.

THE ARMY ANNUAL AND YEAR BOOK, 1913. Edited by Lieut.-Colonel H. M. E. Brunker. 3s. 6d. net. William Clowes & Sons, Limited, 31, Haymarket, S.W.

THE AIRMAN: EXPERIENCES WHILE OBTAINING A BREVET IN FRANCE. By Capt. C. Mellor, R.E. 3s. 6d. net. John Lane, The Bodley Head, London, W.

BACON'S NEW CONTOUR MAP OF THE NEAR AND MIDDLE EAST (THE LAND OF THE FIVE SEAS). Natural scale, 1:6,000,000 = 95 miles to an inch. Size, 40 by 30 inches. Printed in colours. Price, to hang, cut to fold, or on rollers, 7s. 6d. G. W. Bacon & Co., Ltd., 127, Strand, W.C.

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THE DELEI RIVER SUSPENSION BRIDGE, MISHMI COUNTRY.

By LIEUT. F. P. NOSWORTHY, R.E.

FROM September, 1912, until May, 1913, a force, consisting of two companies Sappers and Miners and two double companies of Pioneers, was employed on the construction of a 6-ft. graded mule road from Sadiya to the extreme N.E. frontier of British India. The country proved to be an exceedingly difficult one for roadmaking, and bridges, which had to be of a semi-permanent type, were numerous. Of the eight suspension bridges built, the largest and probably the most interesting was that across the river Delei, a rapid and unfordable, snow-fed torrent, which at the bridge site measured about 200 ft. from bank to bank, and which, according to reports, was capable of a rise of 40 ft.—though this was probably an exaggeration—from 20 to 30 ft. being perhaps nearer the mark. The bridge was designed by Bt. Lieut.-Colonel E. C. Tylden-Pattenson, R.E., officer in Technical Charge Work Party, and constructed by No. 6 Company of the 1st (K.G.O.) Sappers and Miners.

Site.—It will be seen from *Fig.* 1 that the site entailed all those departures from the normal type, which are apt to complicate the design and erection of a suspension bridge.

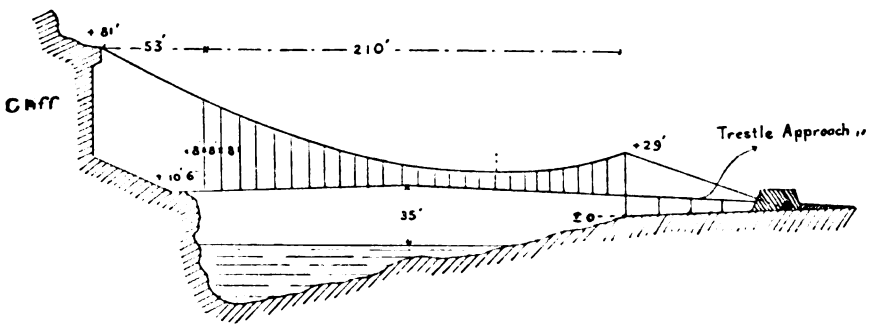

FIG. 1.

In the first place, the cliff on the left bank, whilst affording an excellent anchorage, necessitated a long length of unloaded cable, being much higher than the frame on the other bank. Secondly, in order to reduce the dimensions of this frame as much as possible, and incidentally to shorten the slings which were of exceptional

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length, a dip of 1 in 9 was adopted. Thirdly the downstream rock anchorage had to be at a higher level, and consequently further back, than the upstream one, the result being that the spans of the two sets of cables from pier to pier were unequal. Also, since the right bank of the river was 10 ft. 6 in. lower than the height adopted for the roadway, the shore transom on that side had to be placed 10½ ft. up on the frame and a corresponding increase in the height of the frame was necessary.

Dimensions.—As regards the bridge itself, the span from shore transom to shore transom was 218 ft., and the length of the two sets of cable from pier to pier 273 and 286 ft. respectively. The bridge had to carry loaded pack mules or infantry in single file. The dead load of the structure worked out at 110 lbs. per ft. run, and so the total equivalent dead load to be carried was 320 lbs. per ft. run of bridge. The site would have been an ideal one for a pure "single-ender" bridge had there been sufficient cable to carry this load. As, however, only eight 3-in. cables were available, in order to maintain a factor of safety of 3, a frame of height 18½ ft. above transom level was necessary. Thus the total height of the frame was 29 ft.

Anchorage.—As already stated, the left bank provided excellent rock anchorages. The *Photo* shows the type employed. To prevent excessive bending of the cables these were taken round a 10-in. log of hard wood, in which a jumper was embedded to give additional strength. On the right bank, an ordinary log anchorage was unavoidable. As Bt. Major R. L. McClintock, D.S.O., R.E., pointed out in his article "Bridging with the Burmah Sappers and Miners" (*R.E. Journal*, July, 1911), this type is quite unsuitable for a country in which the life of a log buried underground cannot be estimated at more than three or four years. The only precautions that can be taken are to use as large a log as possible, and to have it well tarred, well drained and freely ventilated. In this case the log was not buried at all beneath the surface of the ground. It was placed on a well-drained platform of rubble stone and the necessary resistance obtained by building over and in front of it with carefully packed rocks. The log itself was 18 ft. in length and 3 ft. 9 in. least diameter, and although no data on the subject could be found in *M.M.E.*, Vol. III., it was estimated that, to withstand the calculated pull of 48 tons on it, 15 ft. of stonework in front and 5 ft. above would be sufficient.

Roadway.—The type of transom used is shown in *Fig.* 2 and was intended to ensure that, while giving ample space for loaded mules, the Mishmis would only pass in single file. It will be seen that, having given the cables a good "waist" to aid in lateral stability, the slings came down to the transoms at a considerable angle. This angle differs of course for each sling, and should be calculated in each case in order to find the slope at which the adjust-

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ing bolt must be set to the transom. It can be calculated by assuming that the cables will lie in the same plane as the line of the adjusting bolts and the line joining the points of supports of the cable.

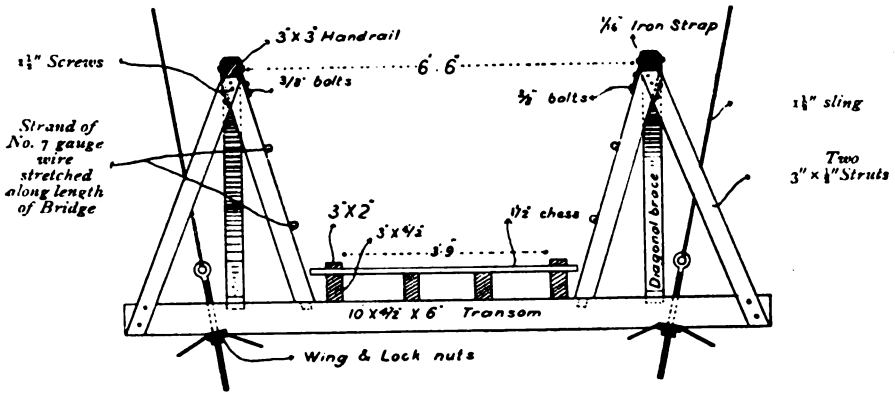

FIG. 2.

Stiffening.—With, however, a span of 273 ft. of cable, a dip of 1 in 9, and a dead load of merely 110 lbs. per ft. run of bridge, it was evident that some sort of girder effect was essential for longitudinal stability. *Fig.* 3 shows the arrangement employed. It was simple and easy to construct and the adjusting bolt (A) makes adjustment at any future date a very simple matter, should any of the girder members work loose. Owing to the outward splay of the handrail, the outside roadbearers could not be used as the lower boom of the girder—and to save the extra weight which would have been caused by the use of two additional longitudinal timbers vertically under the handrail, a 1½-in. steel cable was used for the tension member. At first, the diagonal braces (B) (B) were very lightly connected to each other and to the handrail. It was noticed, however, that when a heavy live load was on one half of the bridge only, the girder towards the further end was subjected to a considerable reversal of stress; so much so, in fact, that after the passage of one or two mule convoys, in both the end bays of the bridge the joints were seriously damaged. This was effectually remedied by the use of heavier iron-work at the joints, the final arrangement being as dimensioned in the diagram. There can be no doubt that for light semi-permanent suspension bridges of any considerable span, a girder handrail should always be provided to stiffen the roadway, and very careful attention should be given to the design and construction of the joints. Nails or screws are quite useless, the stresses due to a moving load causing them to work loose in a very short time. Iron cover plates and bolts are essential.

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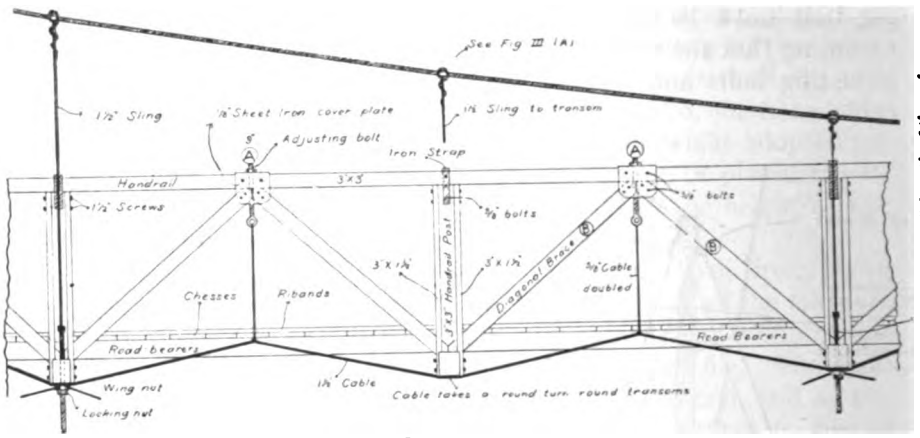

FIG. 3.

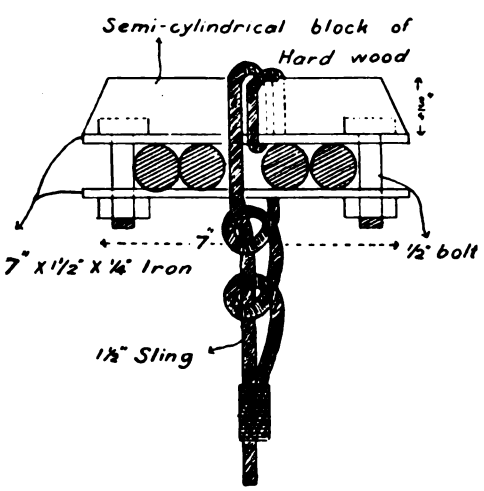

FIG. 3 (A).

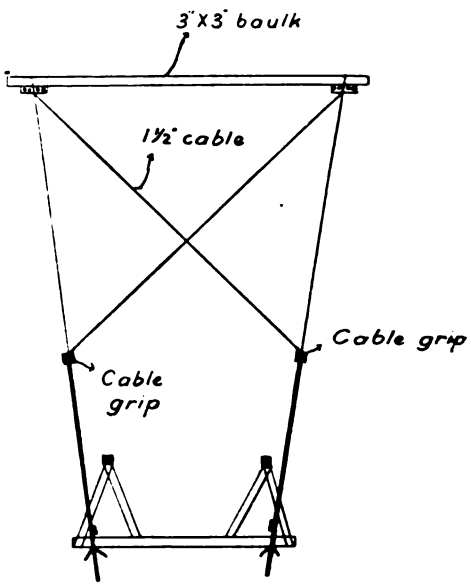

FIG. 4.

The longitudinal stability thus obtained was very satisfactory, but the bridge had a tendency to " roll," which was attributed to the fact that the up and downstream cables were of different lengths. To check this the two were cross-connected as shown in *Fig.* 4. One such cross-connection would probably have been sufficient, but three were made, the great length of the slings making this possible without affecting the headway in the least and the remedy was very effectual.

For lateral stability, two horizontal catenary 1½-in. cables were added. The " dip " of these was about 1 in 9 but a greater dip would have been more effective. Some difficulty was experienced in ensuring that an equal strain was put on to each when tightening up, in order not to pull the bridge out of the straight.

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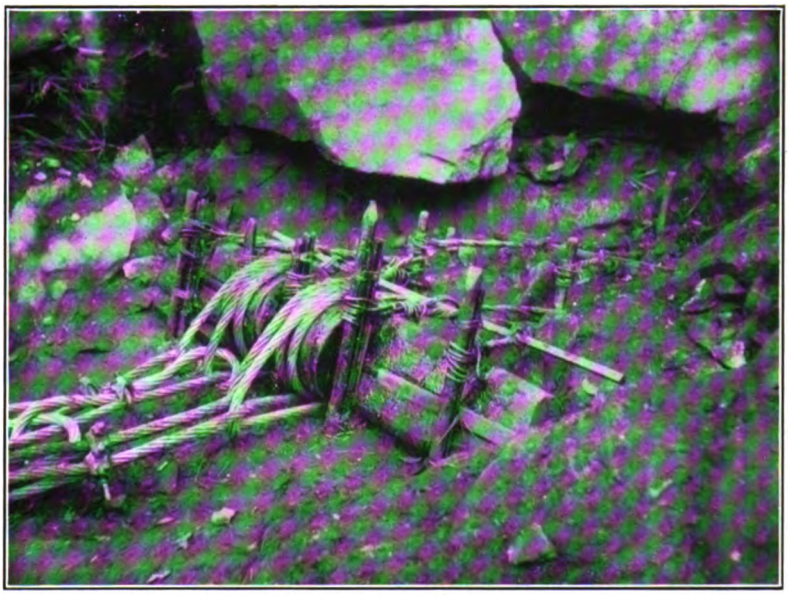
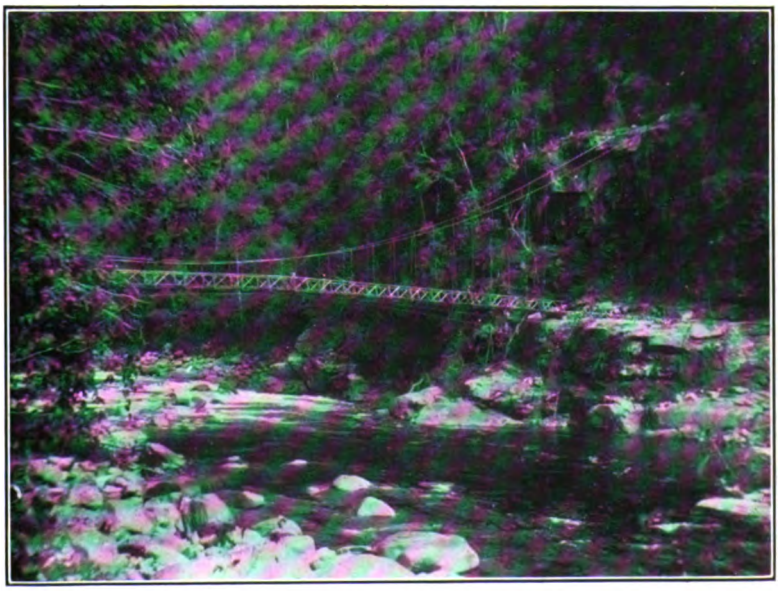
THE DELEI RIVER SUSPENSION BRIDGE, MISHMI COUNTRY.



A Rock Anchorage.



Type of Bridge Employed.

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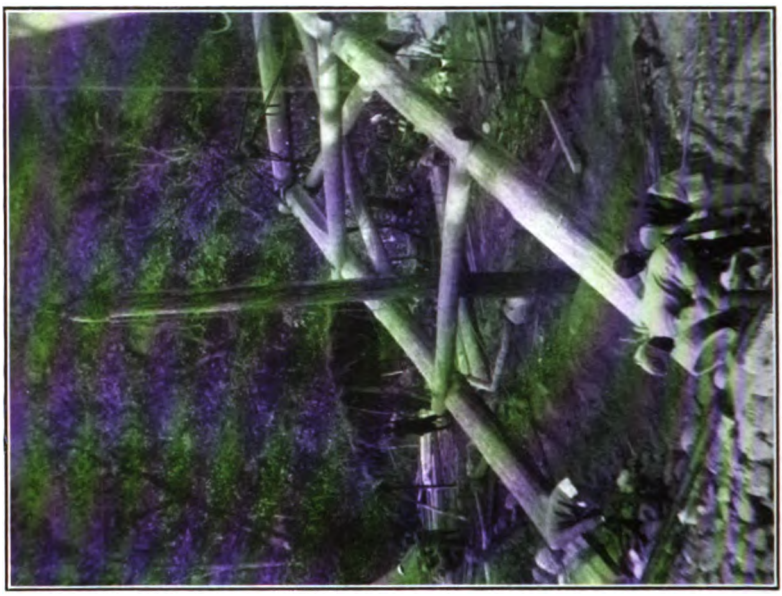
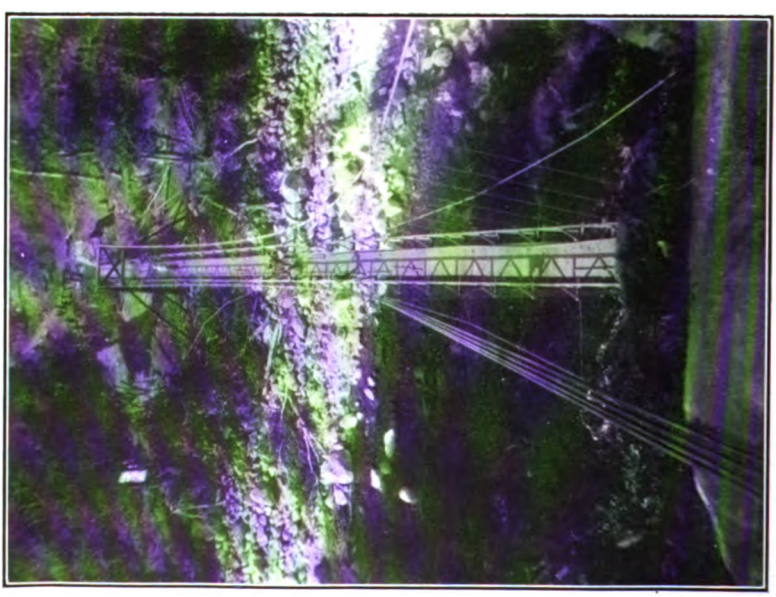
THE DELEI RIVER SUSPENSION BRIDGE, MISHMI COUNTRY.



A Trestle.



View from Cliff Anchorage.

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HEAVY RENEWALS BY THE 26th (RAILWAY) CO., S. & M.

No. 1.—Straightening the New Road.
No. 2.—Dismantling the Old Road.
No. 3.—Turning the Rail over into the Chairs.
No. 4.—Gauging Party.

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HEAVY RENEWALS BY THE 26th (RAILWAY) COMPANY, SAPPERS & MINERS.

By LIEUT. G. D. RHODES, R.E., *O.C. 26th (Railway) Co., S. & M.*

As so many officers seem to be unaware not only of the work done by the Railway Companies in India, but even of their very existence, the following short account of some heavy renewals recently carried out by the 26th (Railway) Company, S. & M., may prove of interest.

Although raised in 1903 and 1905 the development of the companies has been very slow. The original idea apparently was to form a railway battalion of six or eight companies, but up to date only two—known as the 25th and 26th (Railway) Companies, Sappers & Miners—have been raised, and these are quite independent of each other and of the three Corps of Sappers and Miners. The commanding officers are given the title of "Commandant," but are generally subalterns with only a few years' service. The companies, also, were used as stepping stones to employment on State railways and in consequence they suffered from the continual change of O.C.'s. When the present O.C. of the 26th Company took charge he was the seventh O.C. the company had had in six years. This custom has now been discontinued, no change having taken place for two years.

Originally also the companies were only employed in maintaining branch lines where the traffic was exceedingly light, and this hardly tended to efficiency. Both companies were, however, sent to Delhi to build and maintain the narrow-gauge, and part of the broad-gauge railways required for the Durbar. This was exactly the kind of experience required and at the end of their time there (nearly a year) they showed vast improvement, which without doubt will be hard to maintain except with such practice as is described in the following notes:—

HEAVY RENEWALS, MUSHKAF, N.W.R.

Nature of the Work.—Between Sibi and Mushkaf on the main line to Quetta, the permanent way consisted of 75-lb. rails laid in 20-lb. chairs on wooden sleepers. These sleepers had been laid some ten years and it was found that they were badly eaten by white ants. It was at first attempted to repair the road by removing only the worst of the sleepers and replacing these with new ones. It soon,

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however, became evident that the whole section required renewing at once. This was the more necessary as very heavy engines, to haul the trains up the steep gradients to Quetta, are used over this line, and the light 20-lb. chairs were not at all satisfactory. Accordingly orders were issued to renew a length of some 4¼ miles. The new material required, including new deodar sleepers, 40-lb. chairs, spikes, etc., were collected and then distributed along the length. Twelve sleepers were to be laid per rail length, as the 75-lb. rails were somewhat light for the heavy engines in use (between Abigum and Kholpur, where the gradient is as heavy as 1 in 25, 100-lb. rails are used). This gave a spacing of 2 ft. 2 ins. at the joints and 2 ft. 6½ ins. elsewhere, centre to centre of sleepers.

The work was sanctioned towards the end of February, 1913, and as it was desired to complete the job before the end of March, the end of the financial year, it was decided to take 100 men of the 26th (Railway) Company from the Nushki Line to do the work. In addition to the S. & M. about 50 to 60 coolies were also engaged. Accordingly 110 rank and file of the 26th (Railway) Company were entrained and sent into camp on March 2nd.

Method of Working.—Two main systems presented themselves for consideration.

(1). To fasten one chair to each sleeper previous to laying and spiking the other to gauge.

(2). To fasten both chairs to the sleepers previous to laying.

The latter method is probably the quicker, but from experience gained at Delhi it is difficult to get a uniform gauge in this way, unless good templates are made, and as these were not available it was decided to employ the first method.

Owing to the scarcity of men it was impossible to carry out all the operations of boring and spiking chairs, opening out the line, linking, lifting and packing, etc., etc., on the same day. So the system was adopted of opening out enough line, *i.e.* removing the ballast, and spiking on sufficient chairs, to last for two or three days' linking. As there was a speed restriction of 15 miles per hour over the whole section, there was no danger in opening ½ to 1 mile of line at a time.

It had been arranged to run most of the traffic at night, so that we were able to get a clear block of eight hours if required, from 9 a.m. to 5 p.m.

On linking days the method of procedure was as follows :—

(1). Before the arrival of the last train in the morning two fish-bolts were removed from each joint, and the remaining two bolts were first eased and then tightened again to pass the train.

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(2). Immediately after the passage of the last train the line was dismantled for the length to be done that day.

(3). The material was then placed in position and the line linked up.

(4). Finally the line was straightened and roughly packed.

Organization of Work.—For the first day's linking it was decided to do only ¼ mile. This was completed by 5 p.m. but there were many delays owing to the men being in want of practice, material not always being at hand, staggered joints having to be squared, the work being on a curve, etc., etc. After a week's work, however, this amount was completed easily by 3 p.m. and the remainder of the time was spent in packing and straightening, getting material out for the next day's work, etc.

From the 2nd to the 3rd mile the work was speeded up to 60 rail lengths per day (88 rail lengths to ½ mile), the linking still being finished by about 3 p.m.

For the final mile and a-half the length was 88 rails per day, or ½ mile. After roughly straightening and packing the men were dismissed from work about 4 p.m., except the coolie labour which was kept busy lifting and packing the previous day's work.

Half a mile is considered an excellent day's work for the number of men employed, and could not be much increased without undue fatigue to the men. In an emergency, however, 100 to 120 rail lengths (⅝ to ¾ mile) could have been linked, and train passed, by 5 p.m., *i.e.* in an 8-hour block, in favourable weather.

The following was the organization found most suitable :—

Hour.	No.	Men.	Nature of Work.	Tools.
9–9.30 a.m.	12	Sappers	Removing remaining fish-bolts ..	2 spanners each.
	2	,,	Knocking out keys	2 keying hammers.
	6	,,	Collecting nuts, fish-bolts, keys, etc,. and stacking clear of line.	
	3	,,	Turning over rails	3 bars.
	12	,,	Lifting out rails.	
	20	,,	Lifting and throwing out sleepers.	
	12	,,	Cleaning and levelling road bed ..	6 picks, 6 shovels.
	22	,,	Laying new sleepers.	
	6	,,	Aligning and roughly spacing sleepers	100-ft. cord.
	5	,,	Collecting chairs, pins, keys, etc. ..	2 baskets.
Total	100	Sappers.		

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By 9.30 the dismantling was completed, and as men became spare they were reorganized as follows:—

Hour.	No. of Men.	Nature of Work.	Tools.
9.30	14 Sappers	Laying rails in chairs	2 bars.
a.m.	30 ,,	Reinforce sleeper laying party.	
to	2 ,,	Placing chairs in position.	
3 p.m.	12 ,,	Laying opposite rail on two chairs.	
	2 ,,	Distributing spikes and keys ..	2 baskets.
	12 ,,	Linking up fish-plates	2 spanners each.
	2 ,,	Marking sleeper spaces on rail ..	chalk and square.

By 10 a.m. the sleeper laying party became available, together with various odd men. These, after a short stand easy, were organized as gauging parties, 3 men per party, with 1 keying hammer, 1 gauge, 1 auger, and 1 bar, for tools. Sixteen gauging parties were thus formed. These parties were distributed at rail-length intervals, and as each party completed its rail it moved ahead. By 1 to 1.30 p.m. the rail-laying parties finished their work and a continuous line was once more established. As these men became spare they were put on to lifting, straightening and packing. By 4 p.m. the gauging was usually completed and the line ready for trains. If there had been any necessity the line could have been made fit to pass trains by 2.30 p.m. No attempt was made to keep the same men on the same work each day. In fact this was expressly guarded against to allow every man to get accustomed to the different work.

Coolies are not included in the above details. 50 to 60 were fully employed in packing up the line already completed.

The 4¼ miles were completed in 20 days, of which only 12 days were occupied in linking. The remaining days were devoted to opening out the ballast, collecting material, etc. The company remained an additional five days to give the line a final lifting and packing.

Notes on Rates of Working, etc.

Opening out the Line.—This consisted of opening out all the ballast to the level of the bottom edge of the sleepers. Each sapper did two rail lengths per day. Local coolie labour barely managed one length per man per day. The ballast consisted of round river bed shingle, mixed with sand, which seemed to bind it together and make it difficult to open out.

Marking Sleepers for the First Chair.—The position of the chair was found by means of a template and marked. The position of

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the spike holes was then found by placing the chair in position and marking the sleeper through the holes, after which the holes were bored and the chairs spiked on. One sapper bored 100 sleepers (300 holes) and 1 sapper spiked 150 chairs (450 spikes) easily in 1 day.

Putting In and Lifting Out Sleepers with Chairs.—Three men per sleeper proved the quickest, though two men can do the work if there is no bank to carry the sleepers up.

Rail Lifting.—After being turned out of their chairs by three men with bars, the rails were lifted and thrown clear by a party of 12 men. These men worked at the double by word of command or by whistle, and one party threw out ½ mile of rails in ½ to ¾ an hour. This rate is far beyond the capacity of coolie labour.

Putting Rails in Chairs.—This operation was found to regulate the speed of the day's work. The chairs supplied were very tight between the jaws and great delay was experienced in getting the rails into 12 chairs at once. The method finally adopted was as follows :—

The chairs spiked to the sleepers were first roughly spaced and aligned by means of a 100-ft. cord. The rail was then laid on the sleepers inside the chairs. Using the rail as a straight edge, all the chairs were aligned on it by pulling in the sleepers until the chairs touched the rail. The rail was then lifted on to the chair and placed on its side, with the lower table partly in the jaws. The rail was next turned over into the chair. Owing to the tightness of the jaws this latter operation always gave trouble. It was found necessary to send every man to the free end of each sleeper to lift it up and shake it about, while 2 men with bars endeavoured to turn the rail over into its seating. As every sleeper had to be manned 12 men were required, plus 2 with bars, making a party of 14 under a N.C.O.

If the chairs had been easier in the jaw, the first alignment with the cord would have been sufficient and the rail could then have been dropped directly into its seating. Twelve men would have been sufficient and the ½ mile would have been completed at least 1½ hours earlier, *i.e.* by 12 noon.

The party putting in the opposite rail consisted of 12 men and no difficulty was experienced as the rail was put into two chairs only, one at each end, and the remaining chairs were afterwards slipped into their places from underneath the rail.

Marking Sleeper Interval on Rail.—The interval centre to centre of sleepers (2 ft. 2 in. at the joints and 2 ft. 6½ in. elsewhere) was marked off on one rail, and the corresponding position then squared off on the opposite rail.

Gauging the Opposite Rail.—For this purpose parties of three were formed. One man held the sleeper close up to the rail and chair with a crow-bar, one man bored holes, and the third drove the spikes and tested the gauge. Each party was given a rail

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length to do at a time. It was also responsible that all the sleepers were spaced correctly under their chalk marks and square. The outside hole in each chair was first bored and the spike half driven; the gauge was then tested and adjusted if necessary, and the remaining two holes were then bored and spiked.

The fastest time made was one rail length (including 12 chairs, 3 spikes per chair) gauged, bored, and fully spiked in ½ hour. The average was, however, usually ¾ hour. Sixteen parties were formed and they generally completed the ½ mile about 2 hours after the linking in had been completed. If another 20 to 30 men had been available the work could thus have been easily speeded up by at least 2 hours.

On this basis with 150 sappers and with correctly fitting chairs, it ought to be possible, with only a 4-hour block, to complete ½ mile of heavy renewals. To make this daily average, in addition to the above, at least 75 coolies would be required for opening out the ballast, and 25 to 50, in addition to the ordinary gangs behind, for lifting and packing, etc.

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LOCAL COUNTER-ATTACKS.

By CAPT. J. E. E. CRASTER, R.E.

IN the whole business of war there are few undertakings more difficult than a local counter-attack, and none that are so seldom brought to an entirely successful issue. This is due to two causes:—

1. Because field defences, and defensive tactics, are rarely designed to favour them.

2. Because the opportunities for them are fleeting and are seldom anticipated by the defending force, so that the counter-attack is not launched in time, or else is not launched at all.

If the most is to be made of local counter-attacks, they must be kept in view from the moment that the defensive position is chosen. For instance, if a force takes up a position with an extended field of frontal fire, it is probable that the enemy's advance will be checked by a heavy fire while he is still a long way from the position. In this case opportunities for local counter-attacks will never arise, and the defenders will have the mortification of waiting impotently while the enemy develops some new method of attack.

Repeated instances of this occurred during the South African War, for the country offered many positions with extended fields of frontal fire, and it was these positions that the Boers chose. As a result the British advance was generally checked by long range fire, and the Boers had few, if any, opportunities of making local counter-attacks. Consequently they were never able to strike a vital blow at the British, and the latter withdrew their troops, often without serious loss, and always without serious disorganization.

No decisive result can be expected if the enemy does not come within striking distance. It is only therefore when a defending force is fighting a purely delaying action, that it is justified in holding the enemy at a distance with long-range fire. The normal object of the defender should rather be to lure the enemy on until he is close to the defence works, then to disorganize his troops with a heavy burst of fire at close range, and finally to crush them with a counter-attack.

These tactics demand a great deal of self-restraint on the part of the defending troops, especially if they are posted in works from which they can overlook the whole of the enemy's advance. It therefore seems desirable that the defender's main works should be

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posted on the rear crest of a ridge, or in some similar position, where the field of frontal fire is limited to some 600 yards. This position has the further important advantage of rendering the works difficult to locate, and so protecting them from the attacker's artillery; the communications are easily concealed, and the local reserves, which are to make the counter-attack, can generally find cover close to the works.

But because the rear crest is deliberately chosen for the line of resistance, the forward crest should not be abandoned altogether; though the enemy is to be lured on, this does not imply that in the more distant stages his advance is to be quite unmolested. The forward crest, in fact, must always be held in sufficient strength to prevent the enemy from bringing any formed body of troops within range of it, but the exact amount of resistance that should be offered as the enemy advances to the forward crest can only be determined during the course of the action. It should never be enough to check him altogether.

Some French writers have urged that the forward crest should be held in sufficient strength to compel the enemy to carry it by assault. Then as soon as the assaulting troops appear over the crest line they will be caught by the fire from the main line of works, and thrown back by a vigorous counter-attack. This method, however, demands a very large number of men, for there are virtually two lines of works to be held in strength, and the defenders will need as many men per yard of front as the attacker. Also the fate of the garrisons of the forward line of works does not appear to have received very sympathetic consideration.

Where the topographical features are ill-defined, crest lines disappear, and a defensive position becomes an irregular line of localities, which must be held because, for one reason or another, they are of tactical importance. Here again the defences must be designed in such a way that the enemy's attack is not checked at too great a distance. This may be contrived if the security of each locality is made to depend more upon the flanking fire from the neighbouring localities, than on its own frontal fire. In short, the rule for the fortification of such localities should be—a few small, and well-concealed works to sweep the front, but numerous, and well-armed works for flank defence. Machine guns should always be provided for the flanking works, as they are peculiarly suited to this *rôle*, and their position on the flanks should prevent them from being put out of action by the enemy's fire. Field guns may also be used with advantage.

The use of highly developed flank defences of this nature is the most certain method of ensuring that the defending force shall have a marked superiority of fire at the decisive moment, for though the attacker may smother the frontal defensive works with fire, it should

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be impossible for him to silence the flanking works. It should also be remembered, in this connection, that the flanking fire of one rifle has more moral effect than the frontal fire of ten. Nothing can be more disconcerting to the attacking force than to be caught by a heavy burst of flanking fire just as they are preparing for the assault.

But all these preparations for the counter-attack will be useless, if the commander of the local reserve misses his opportunity. The *Field Service Regulations* lay down that local counter-attacks shall be delivered on the initiative of the section commander. But as the opportunity for a local counter-attack is generally short—a matter of minutes only—it seems probable that it will be missed altogether, unless the section commander is with the local reserve and can give his orders on the spot. If the section commander is not with the local reserve, he should delegate the initiative to the commander of the reserve.

The opportunity for a counter-attack will normally arise when the flank defences have come into action and the defender's fire has reached its maximum. A good rough rule for the commander of the local reserves would be, that he should advance to the counter-attack as soon as the machine guns in the flank defences open fire. If he does this, he will usually allow just sufficient time for the flanking fire to attain its greatest effect before he reaches the enemy with the bayonet. But every case must be judged on its merits. The point to be insisted on is, that the commander of the local counter-attack must study the flank defences very carefully before the action, and see for himself the exact spot in the enemy's advance where the flanking fire will strike him. When the enemy reaches that spot he will know that the decisive moment, the time for the counter-attack, has come.

It may be objected that this is far too rigid and mechanical a method of judging the moment for the counter-attack. No doubt a military genius, relying entirely on his own instinct, might select a more favourable moment. But it is not safe to count on the commander of the local counter-attack being a military genius, and it is far better that he should judge his opportunity by the foregoing method, than that he should trust to a chance inspiration. The danger is that, unless he has made up his mind beforehand to attack at a certain moment, he will never attack at all.

To consider the practical details of the system. In order that the section commander may perfect all his arrangements, he should have a plan of his section prepared at the earliest opportunity. On this plan should be shown all the defence works, and the field of fire of each, both to the front and flanks. By studying this plan he will be able to judge very rapidly—much more rapidly than by inspection on the ground—what additions, and modifications, will

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be required in order to make his defences complete. A good rule to follow in this respect is that the enemy should not be able to approach within 300 yards of any work, without being exposed to a heavy flanking fire at an effective range—less than 1,000 yards—from one or more other works.

When his works are complete, he should mark on the plan the points at which the enemy will come under the heaviest fire, that is the points where he will be caught by flanking fire from one, or more, works. The section commander should then go over the ground with the commander of the local reserve, and show him these points. The position of the local reserve can then be allotted, and the line of advance of the counter-attack selected.

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THE ORGANIZATION AND DUTIES OF FIELD COMPANIES, R.E., IN PEACE AND WAR.

A Lecture delivered to No. 3 Senior Officers' Class, S.M.E., by MAJOR R. N. HARVEY, D.S.O., R.E.

THE subject of this lecture is The Organization and Duties of Field Companies in peace and war, and the easiest way I think of realizing the real capacity for work which is implied by the words "1 section of a Field Company, R.E." which so frequently figures in all orders now, and is on manœuvres represented by two sections of fours, or even less, is by studying the tables which show its actual peace and war establishments. It is because the sections are so weak in peace time, that the real advantage of possessing such a unit would seem to be so often overlooked by commanders in the field. It may be difficult to think that six or eight men, R.E., followed by a tool cart, is likely to bring any important bearing on a field operation, but this only requires the exercise of a certain amount of that same imagination without which no peace manœuvres can be successfully conducted. When we see clearly what the section, field company, R.E., really means, perhaps imagination may be assisted.

Now considering the officers and dismounted portion only, the peace establishment of a field company is 3 mounted officers, 1 C.S.M., 4 sergeants, and 110 rank and file, but the actual peace strength of the dismounted rank and file of a field company is never as much; a third of the peace establishment being deducted for the purpose of forming a training depôt; and other casualties reduce the actual strength to about 70; therefore for manœuvres the strength of a section cannot be expected to be above about 16 rank and file, and even this small total is rarely realized.

Horses and Vehicles.—The number of draught horses allotted in *peace* time is 18, and with these can be horsed either four double tool carts and a water cart, or the three bridging equipment wagons. Thus you see that, though the peace equipment vehicles consist of four tool carts and four forage carts, one G.S. wagon and three bridging equipment wagons, horses are only provided for a certain proportion of these; and all the vehicles of a field company, R.E., cannot be made simultaneously available unless horses are borrowed from other units, which is very difficult to arrange. The water cart is a mobilization vehicle, but is specially exempted from the restrictions to which the remainder of the mobilization equipment is subject, and it is available for use in camp or on manœuvres.

Personnel.—As you doubtless know, the dismounted portion of a field company is recruited from the tradesman class, and up till

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recently every sapper was a tradesman of a specified trade, but the latest approved establishment include a certain percentage of men called pioneers. These men, though they certainly may keep up the numbers of the corps, are not tradesmen, but are what may be called "tradesmen's mates." Under certain conditions they are allowed to learn a trade and become sappers. The possession of the tradesman in the corps is very precious, and if we are to continue to enlist them we must give the men a chance to improve their trade qualifications while they are with us, so that they may not be handicapped on their return to civil life. This is a very important factor to be kept in view during the annual training of a field company. The mounted portion are enlisted quite separately, and are trained in mounted duties only. They are not available for work with the dismounted men except as drivers of vehicles.

Organization.—The company is organized in headquarters and four sections: each section is a self-contained unit, and may be detached from its headquarters for a considerable period at a time. An example of this is the 11th Company, R.E., in South Africa, which had at one period its headquarters at Mafeking, one section near Rustenberg, one section near Belfast, and one section at Komati Port; one of the sections was absent from headquarters 18 months.

The section is the only subdivision of a field company; there is no such thing as half a field company, R.E. If more than one section is detailed in orders, the proper designation is two sections, or three sections.

Equipment.—I think that all I need say of the equipment of a field company is that it consists of sufficient entrenching tools, cutting tools, and tradesmen's tools to meet the requirements of the company. These tools are not available for loan to other units except in very special circumstances; in addition to these tools, explosives and water supply equipment are carried. The former consists of about 560 lbs. guncotton, fuzes, etc. This latter is a figure to be remembered, for it frequently happens that the demands for explosives on even one field day are far in excess of the amount actually carried. The water supply equipment consists of four pumps and four troughs. This is supplemented in peace time.

Training.—The training of a field company follows the same general lines as for the rest of the army. During the individual training season the men are employed at their trades, and every effort is made to reserve a suitable piece of work, included in the Barrack Annual Estimates, for execution by each field company; for instance, a block of officers' quarters, a stable, or a block of shops and stores and other similar buildings. It is found that by this means the officers, N.C. officers and men obtain training in the general engineering and building branches of their profession in its most interesting form. During this period too, opportunity is taken to instruct N.C. officers and men in R.E. reconnaissance, map reading,

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signalling, and other duties required to be known by them in war time, by lectures during the winter evenings and as opportunities offer.

Collective Training (*E.T.*, Ch. III.).—Collective training includes drill (which is of course practised all the year round), musketry, and the annual course of fieldworks and the special course of bridging. This is usually completed by the end of June, and then the company is available for collective training with other branches of the Service.

Field companies are attached to brigades during brigade training, and in the divisional training and manœuvre period they are allotted to their own divisions. Thus you see the training of the field companies is as progressive as that of any other portion of the field army. With us, as with the rest, the object of all training, including the period devoted to building, is for efficiency in war. The collective training includes all the preliminary training for field engineering, but it is when we are affiliated to brigades and divisions that we endeavour to acquire our realistic war training.

In the absence of definite regulations on the subject, the correct employment of field companies in the field has not always proved to be a simple matter, chiefly, I think, because the R.E. equipment and training was not familiar to anyone but themselves. In days gone by, the possession of a field company by a commander of a force was regarded as a nuisance, and unless there was a very obvious opportunity for employing it on trench work or bridge building, it was relegated to the rear, and I have known of a commander of a force being surprised to hear that the R.E. carried rifles and could be used as infantry. This of course was several years ago. Now that the *Engineer Training Manual* has been published, there should be no more confusion.

Generally speaking, the duties of the R.E. on service are :—" To apply engineering science to the emergencies of modern warfare, in order to protect and assist troops ; *to ameliorate the conditions under which they are serving ; and to facilitate locomotion.*"

The general principles of employment of the R.E. are shortly, as follows (*E.T.*, Section 85) :—

1. Their work must conform to the tactical situation and the plans of the commander of the force.
2. Engineer work *requires time*, and therefore the engineer commander must be informed of what may be required of him early, or time may be wasted and work incompleted.
3. To assist in the same object, the engineer commander must organize *engineer reconnaissance*, after consultation with the staff.
4. The work required from the engineers may be too much for the numbers available. The engineer commander must inform the commander of the force if this is the case, and obtain from him the order of priority to be given to the various works.

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5. The number of engineers is limited, and therefore every care must be exercised to see that they are employed only on such work as demands technical knowledge or special tools.
6. Engineers must always be prepared to defend themselves, and may, *in an emergency*, be employed as infantry.

The number of field companies in a division is two, and the engineer commander of a division is the C.R.E.

General Employment in Peace and War (*E.T.*, Ch. VII.).—My object now is to put before you the employment of field companies in peace and war, and I think it will be best to study the duties of the R.E. in war, and then see how we can obtain training for these duties in peace.

The new *Engineer Training Manual* lays down that the work of the engineers is to aid the other arms in carrying out the intentions of the commander of the force.

Engineer officers, to do their work effectively in co-operation with other arms, must have a clear grasp of the intention of the commander of the force, otherwise the men may be tired out by work of temporary importance when the situation really demands that they should be kept fresh for something later in the day. I propose to deal with these duties under the following heads :—

1. March duties.
2. Passage of rivers.
3. Quarters.
4. Attack.
5. Defence.
6. Retreat.
7. Night operations.

1. *March Duties* (*E.T.*, Section 96).—A proportion of the R.E. should be with the advanced guard and the remainder should be near the front of the main body. The reason for this is given in the last two lines of the quotation I made a moment ago.

The rate of progress of an army along a road depends upon its nature, and it is most important that all obstruction should be moved therefrom as quickly as possible, in order to obviate checks. These obstructions may take the form of :—

(1) A length of bad surface.
(2) A broken, or unsafe bridge or culvert.
(3) Sudden narrowing in a cutting.
(4) Sharp corners, or
(5) Trees felled across the road.

Technical knowledge, or special tools and equipment, are required to deal with all of these, and the sooner the R.E. with the troops can get to the obstacle the quicker will it be removed or a proper scheme prepared for the execution of the necessary work.

If the work is greater than can be efficiently dealt with by the numbers at his disposal, the R.E. officer in front can send back an intelligent professional report to his immediate senior who can, from his report, frame a scheme, requisition for the working party from the troops, and hasten up additional vehicles and tradesmen required for the work from the R.E. with the main body. Meanwhile the R.E. officer with the advanced guard would collect all information

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regarding material, extra tools, or natural resources of the neighbourhood. It is easy to see that by this disposition of R.E., any work which may become necessary is more quickly and efficiently dealt with, than if the technical officers and their skilled tradesmen are kept back in rear of the column.

Now the training for this work is not difficult to effect in peace time; the reports and all paper work can be done and valuable practice can be obtained in getting out schemes, if a reasonable amount of imagination is exercised in this branch of our work which we call engineer reconnaissance, but it cannot be done unless the R.E. are properly disposed of in the order of march. It may seem unpractical for a small body of R.E. with their vehicles to be sent with an advanced guard, and the work which they may be actually capable of doing may be very small, but experience shows that we must practice in peace the dispositions which obtain in war, and engineer reconnaissance must be practised continually if the work on the march on service is to be done expeditiously. In addition to this road work, arranging a temporary water supply must be mentioned. The latter is of course frequently carried out.

The *Engineering Training Manual* lays down in Section 96 (1), that the bridging equipment vehicles will accompany the train unless it is likely that they will be required during the march. In my opinion this policy is unsound. Unless a road has been thoroughly reconnoitred beforehand no one can tell from the ½-in. map alone whether bridging will be necessary or not. If the bridging equipment is required at all it is required at the head of the column in order to pass guns and vehicles over a gap without delay. An infantry division is 14½ miles long, *i.e.*, three hours' march at least for the bridging wagons if they were at the head of the train.

The three bridging wagons occupy a space of 60 yards. Apart from the evils connected with disintegrating a unit the advantage of saving 60 yards in a length of a column of 14 miles does not appear to me to be equivalent to a possible delay of three hours.

2. *Passage of Rivers* (*E.T.*, Section 98).—Engineer work in connection with this includes:—

(1) Reconnaissance.
(2) Construction of bridge from equipment.
(3) Construction of bridges from material collected locally.
(4) Improving an existing means of passage.

As regards reconnaissance, it is of course of the utmost importance that the bridges should be constructed to suit the tactical scheme, but it must be remembered that the selection of a site without regard to the nature of its approaches may result in such delay in the construction of the bridge and its approaches as to render it worthless, so that sometimes the actual site must be a compromise. For this reason therefore it is essential that a R.E. officer should be present

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when the site is selected. All this work can be practised in peace, and very valuable it is.

3. *Quarters* (*E.T.*, Section 107).—Under this heading would be included all work in camps and bivouacs, both for defence and comfort of the troops. All of you, of course, are well acquainted with the work the R.E. do in camp, but probably do not know the difficulties we labour under to get it done.

Water supply is the most familiar and the most important of these duties. Here again, we want time. Men and horses come into camp after a long march parched with thirst, the sight of possible water increases this; both men and animals are very difficult to control under the circumstances, and in the turmoil and fighting for water the R.E. are hampered, their equipment is broken and rendered useless, and everyone suffers.

Given a hint of the probable site for camp, given a chance to have a first look at a possible water supply with the medical officer, so that a scheme for the distribution of the equipment and labour may be made before the troops arrive in camp, the R.E. can obviate much of the discomfort and hardships above-mentioned, but they must be backed by orders issued by the staff and an efficient water police service. The difficulties of the R.E. do not cease when the arrangements are made and the pumps and troughs have been put down. Next morning the force probably moves off early, and as I have already shown the R.E. are well forward in the line of march. They must start at the proper hour, but before marching they must pick up their equipment. Orders must therefore be published stating the hour up to which the water supply equipment will be available. This hour should be settled in consultation with the C.R.E. or senior R.E. officer.

As soon as the army occupies permanent or semi-permanent camps, the training in building to which I have already referred is justified. All of you will recollect how much building was done in the camps in Africa both during and after the war. Without the R.E., little would have been possible, owing to the scarcity of civilian skilled labour, especially up country. In South Africa it was found that units without tradesmen could not take the place of field companies where building operations were involved. Under the term "buildings" I include all accessory works such as a permanent water supply and drainage system, etc.

4. *Attack* (*E.T.*, Sections 109, 110, 111).—Engineer duties in the attack are:—

(1) To assist various arms in the crossing of natural obstacles.
(2) To strengthen a position captured by the infantry.
(3) To remove artificial obstacles.
(4) Communications.
(5) Erection of observatories.
(6) Water supply.
(7) Fighting, if required.

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For the effective performance of all these duties it is absolutely necessary that the engineer commander should know the plans of the commander of the force. From the above formidable list it is easy to picture a field company fully engaged in making a bridge over a stream for the R.A. or cavalry, when what was really required was the removal of an obstacle to the infantry advance.

In peace time many of these things can be done actually. All of them can be done on paper, but they cannot be done effectively unless disposition of the R.E. is the same as for war, and the C.R.E. is acquainted with the intentions of the commander of the force.

The manual lays down that a certain proportion of R.E. should be as far forward as possible. They will be accompanied with the vehicles as far as circumstances admit, and afterwards they will carry tools and explosives, etc. *They should not be relegated to the reserve except for some definite purpose.* The guiding principle is that "engineer work to be useful must be executed in time, and this is impossible if the engineers are kept too far back" (*E.T.*, Section 110 (5)).

A very useful item in the training of R.E. for work in the attack is the quick recognition by all ranks of the nature of works thrown up by the defence. In these days all works are, or should be, carefully hidden, but the presence of even the best hidden work may be given away by some small detail which it has been found impossible to hide. A short length of a straight line may indicate the crest of a parapet or a traverse, a dark shadow may betray the loophole. The R.E. eye should be trained to know what to look for, and how to recognize it.

5. *Defence* (*E.T.*, Sections 112, 113).—The commander of the force will determine the line which will be held by the force. A R.E. officer will accompany the commander while he inspects the line if desired. The distribution of engineer units to sections is ordered by the commander of the force. The commander of engineers is responsible for collection of tools and materials and their issue to commanders of the sections of defence, and for the distribution and supervision of all military and civilian labour not allotted to section of defence, and for all engineer work not specially detailed to the other commanders.

The duties of the R.E. in the defence of a position will include :—

(1) Work requiring technical skill.
(2) Technical advice (when required).
(3) Overhead cover.
(4) Revetments and drainage.
(5) Mechanical alarms and signals.
(6) Assisting in construction of obstacles, etc.

It is most important that the relative responsibilities as laid down should be thoroughly understood by all. In taking up a position

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the R.E. officer attends, if desired, in order that he may be at hand to give technical advice as to how the R.E. can best be employed in carrying out the wishes of the commander of the force.

It frequently happens that the commander may be unable to inspect a position himself, and may send his senior R.E. officer to do this for him. In this case his instructions to the latter should be perfectly clear as to whether he requires :—

(1) A scheme for the defence of the position, or
(2) A reconnaissance and report on the position on which the commander may be able to frame a scheme for the defence.

If he desires the former, he must give the R.E. officer the detail of the troops which are available for the defence, otherwise the scheme may be far too elaborate or quite inadequate, and time is lost while the scheme is revised. Now it is only by the perfect co-operation on the part of both the commander and the senior R.E. officer that any scheme of defence can be thoroughly efficient. This co-operation can only be arrived at by means of frequent practice, and as I have mentioned before, we regard the periods of brigade and divisional training as the most important for us, as being our best chance of learning how we can best serve the commanders of mixed forces in this respect—by this means only can harmonious working in war be assured. The remaining duties are carried out regularly in peace time during the annual fieldwork course. It is now laid down that the trench work of the field company fieldwork course should, if possible, be done in co-operation with the infantry, and this is the foundation of the co-operation required in taking up a defensive position.

6. *Retreat* (*E.T.*, Section 115).—A strong party of R.E. should be sent either with, or ahead, of the advanced guard to assist in preparing for the defence of such rallying positions as may be selected by the commander of the force.

The whole object of the action being for delay, it depends upon the circumstances of the case whether this can be effected best by demolition or trench work, but as a general rule determined pursuit can best be checked by fighting, and strengthening points in a rallying position will usually obtain priority. The R.E. work in a retreat will therefore include :—

(1) Preparation of bridges for destruction.
(2) Improving line of retreat.
(3) Closing fords.
(4) Obstacles.
(5) Destruction of telegraphs, water supply, and railway lines.

In order that the pursuit may be effectively delayed by the above, the senior engineer officer with the force must have the confidence of the commander of the force. If there is not complete sympathy

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between the two, it is easy to see how a portion of the retreating force might easily be cut off from the main body by the premature destruction of a bridge, or an easy channel of access from a flank be left open to an enemy.

Having sent the bulk of the R.E. with the advanced guard to do work, there are few left for the rear party, but this will gradually collect the different parties of R.E. as they catch them up, and by proper organization, there should be no difficulty in providing sufficient R.E. with the rear party to ensure the completion of important demolitions, or ensuring the following precautions being taken :—

(1) Narrow roads blocked.
(2) Fords blocked.
(3) Boats burnt.
(4) Villages, heather, etc., burnt to make a smoke screen.
(5) Demolitions.

The bulk of this work must be done on paper during peace, but frequent staff rides and regimental exercises would give very valuable training in this subject.

The question of the defence of a position has already been dealt with, and in the case of a retreat it is easy to see how it might be impossible for a commander himself to choose the position on to which he wished to retire.

Night Work (*E.T.*, Sections 116, 120).—*Reconnaissance.*—As before stated, the R.E. work is to be directed to the assistance of the other arms, and in this case as with others, reconnaissance is one of the most important duties. The R.E. officer can only do this with the complete confidence of the commander, for he must conduct his reconnaissance in such a way as not to betray the commander's intentions.

The object of this reconnaissance is twofold :—

1. *The Start :—*
   (*a*) To facilitate start.
   (*b*) Remove obstacles.
   (*c*) Improve communications.
   (*d*) Cut gaps.
   (*e*) Fill ditches, etc.
2. *The Route :—*
   (*a*) Block roads not to be used.
   (*b*) Erect signposts.
   (*c*) Deaden sound on bridges.
   (*d*) Marking of route, and position of assembly or deployment.
   (*e*) Sites for trenches at position of deployment.
   (*f*) And for a night attack we should include reconnaissance of obstacles, how they are lit up, how defended, and how best to cross them.

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Night March.—Work found by reconnaissance may either be done before or during the march. If before the march, the R.E. can be concentrated at the objective of the march; if during the march, the R.E. must be at the head of the column ready told off into parties, carrying all the tools and materials required. If no reconnaissance has taken place, R.E. will be in the front.

Night Attack.—The chief duty is to remove obstacles in front of the position, and for this the R.E. must accompany the scouts, and, regardless of loss, remove them and afterwards advance with the leading troops. The men must *carry* with them all tools and materials they require. The R.E. told off to the preparation of the captured position for defence march with the third line ready to start work. All this night work can be practised in peace with not much imagination. The importance of night work cannot be exaggerated, and in order that we may be trained for the confusion and difficulties of it we should be constantly practised with other arms during their company, battalion, and brigade training.

Now I have run through very briefly the organization, training, and employment of the R.E. in peace and war, and from my remarks you will have gathered that a great deal of the successful war training of the R.E. lies in the degree of confidence extended by the commander of the force to his senior R.E. officer and the power of imagination possessed by the latter. Without this, the R.E. officer can do little to instruct his men, for they soon find out whether their work is practical or not, and if not, their interest flags and training dies.

I have frequently dwelt upon the importance of reconnaissance—without this all R.E. work is delayed. Timely information transmitted from the front may save hours of delay, and miles of extra marching.

Field companies have now 32 bicycles in war, and in peace there are usually a few volunteers riding their own machines at the usual government rates. With these bicycles the capacity for reconnaissance and intercommunication has been so very greatly assisted, that we all hope that in the next campaign the time taken over R.E. work will be sensibly reduced. The position of the R.E. at the front of a column has been arrived at by a process of trial and error, by which it has been found that the closer the R.E. are to their work, the more they can do, and the quicker they do it. We hope that this opinion has come to stay, and that in the future when the R.E. are required it will not be necessary to order them to the front from the tail of the column to take on a piece of work of which the officers have had no previous information.

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THE WORK OF R.E. RAILWAY UNITS IN WAR.

A Lecture delivered to No. 3 Senior Officers' Class, S.M.E., by MAJOR G. LUBBOCK, R.E.

I PROPOSE to describe first the concentration of a large force, and a practical application of the system of communications in rear of an army which is given on p. 132 of the *Field Service Pocket Book*.

It is assumed for present purposes that both Bristol and Birmingham are seaports, where a "Blue" force has landed to co-operate with the English Army against a foreign invader "Red," who has established himself in the north and east of Norfolk. It is also assumed that the English authorities have placed at the disposal of "Blue" two lines for concentration, viz., (1) the line from Bristol *viâ* Swindon and London to Biggleswade and Royston, and (2) from Birmingham *viâ* Northampton, Bedford, and Sandy to Cambridge. The area of concentration is the triangle Hitchin, Sandy, Cambridge. I assume also, of course, that our war establishments are the war establishments of "Blue."

To trace the series of events concerning railways from the first day of mobilization :—

Among the first people to appear upon the scene from Blueland are the administrative staff of the Inspector-General of Communications (I.G.C.). With these is the Director of Railway Transport (D.R.T.), his deputy, and his assistant, and 30 officers, and a few others whom you will find duly detailed on pp. 30 and 193 of *War Establishments* under the titles "Administrative Services and Departments," and "Railway Transport Establishment."

The first business of the D.R.T. is to get in touch with the authorities who actually work the lines allotted to "Blue." He himself and the assistant D.R.T. will probably get off to London to see the L.N.W. Railway, G.N. Railway, and G.W. Railway people. There he will find how much rolling stock can be allotted for the use of the "Blue" army, what loads can be hauled and at what speeds, and on this he will get out a table of normal train compositions similar to that shown on p. 153 of the *F.S. Pocket Book*. This table will govern the number of trains he can run per day with the engines and rolling stock allotted. When he has made himself acquainted with these matters, he will give the I.G.C. and, of course, the C.-in-C., information showing exactly how many troops can be got off each day from each base. He should already have information as to the

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total numbers to land at each port and will allot its proportion of rolling stock to each line.

Knowing the area chosen by the C.-in-C. for concentration, he will find out which are the most suitable stations for detrainment in this area, and decide which stations are to be used for the detrainment of the various formations and units. For this purpose he will probably be accompanied in the first instance by an officer of the General Staff, because though general staff requirements will be paramount they must of necessity conform somewhat to the railway facilities available.

I may say here that when any troop concentration is contemplated or in progress the D.R.T. should, I think, be directly under the C.-in-C. and in close touch with his staff. Once concentration is over his place is, as shown in *War Establishments*, with the I.G.C.

Having arranged these matters the D.R.T. will leave his assistant to get out time tables and arrange all details with the railway officials, while he himself will get back to the base, and will probably post the rest of his staff as follows :—

One D.A.D.R.T. and say four railway transport officers at each base.

One D.A.D.R.T. and one railway transport officer each at Swindon and Northampton, and two railway transport officers at each detraining station which we may take as Hitchin and Royston for the Bristol line, Potton and Biggleswade for the northern ones. By this time the troops are beginning to arrive at each port.

Let us take the series of events at Bristol and on the southern line. On the evening of the 10th day for instance, the Base Commandant should have full details of all troops due to arrive on the 11th day, and this information he passes to the D.A.D.R.T. This officer makes out a statement of the trains he will require for these troops, which will be due to leave on the 12th day ; this he sends to the D.A.D.R.T., Swindon, and during night of the 11th—12th these trains will be made up at Swindon. This statement will of course be based on the normal train compositions already decided on in London, and will show the order in which the various compositions are wanted.

Possibly owing to want of some particular class of trucks the officer at Swindon cannot make up the trains in just the order wanted, but he will comply as far as he can, and during the night of the 11th—12th he should be able to wire the D.A.D.R.T., Bristol, the times and order of arrival of the empty trains. The D.A.D.R.T., Bristol, who has, of course, the running time tables furnished from London, then makes out on this a time table of departures for the 12th day, and issues these to the R.T.O. at Bristol, and to troops who will have landed on the 11th day and are now in a rest camp.

The R.T.O.'s business, as you know, is to show the troops where and how to load their horses, vehicles and men and to see them into

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the train and off by the proper time. He will wire off to the R.T.O. at destination the name of unit, etc., and time of departure. The latter has to get them out of the train as quickly as he can and send them on to their bivouac or rendezvous. The empty train is sent back to Swindon as fast as possible, where it may have to be broken up and re-marshalled in accordance with next day's requirements.

I say it may have to be broken up, but to make the best use of the rolling stock available, re-marshalling should be avoided as far as possible. It can be avoided to a great extent by forming the normal compositions so that they can take the maximum number of different units or portions of units. Thus the normal artillery train should be such that it can accommodate convenient subdivisions of horse batteries, field batteries, ammunition columns, etc., and the normal infantry and cavalry trains should be formed with the same object. But to endeavour to cram all units into three or four standard compositions must, I think, result in some waste of train space, and a certain amount of re-marshalling is therefore the lesser of the two evils.

If the proportion of infantry, cavalry and artillery to be despatched each day were the same, we might certainly get along with little or no re-marshalling. But it is inevitable that the proportions will vary on different days; and to put a series of infantry battalions into cavalry trains, no matter how much you mix up the units, will never, I think, be an economical proceeding.

There is one point here to which I would draw your attention as it arises in most troop movements. By the morning of the 12th day there will probably be 15 to 20 trains made up and standing in the sidings at Swindon, and placed with a view to their going in a particular order. That is to say, you may have in one long siding five or six trains of different compositions all standing in a row. They will come out all right in their order, but if the last train is wanted first it may mean an hour or two additional shunting, and blocking half the yard during that time. Therefore it is important from the railway point of view to settle the order of despatch beforehand and not to change it at the last minute. Of course in war where units are all at war strength you can interchange battalions with battalions, batteries with batteries, etc. In peace time at manœuvres, etc., you cannot even do this as a rule. The other day before dispersal after manœuvres when standing room had to be found for a large number of trains, the Great Northern Railway had some 20 trains standing all in a row north of Hitchin on a length of goods line which was temporarily closed for the purpose. It would have been next to impossible to get these out in any order other than that in which they were arranged, and it will be obvious that for the same reason it would be impossible to alter the composition of any train while it is so stabled, and as a rule there is no time to shunt vehicles on or

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off once they begin coming out of the sidings to their entraining stations.

Assume now that concentration is completed and that the " Blue " L. of C. is confined to the northern line through Bedford and Northampton with Birmingham as its only base. The D.R.T. is with the headquarters of the I.G.C., probably at Bedford, which is the " regulating station," because I think that what is known as the regulating station will be rather an important centre on the L. of C. His deputy will probably be at the headquarters of the C.-in-C., because it is most necessary that the C.-in-C. should always have advice on railway matters immediately available. If Northampton were the advanced base, just as it was " Blue's " advanced base at manœuvres, we should have another D.A.D.R.T. there. But in the case of a force operating such a short distance from its sea base, I doubt if we should have an advanced base at all. The advanced base is really the main supply depôt where we are supposed to have 15 days' reserve supplies and from whence trains are made up daily with the various rations in their proper proportion for each division. Even if the C.-in-C. considered it safe to have a large reserve so close to the area of operations, there does not appear to be any advantage in moving all our supplies from the base only to dump them a bit farther inland. Therefore in the case in point, and probably for any distance up to 150 miles at least, we shall have nothing between the base, which becomes the main supply depôt, and the regulating station.

At the base is the D.A.D.R.T. whose business is in allotting the necessary rolling stock to the various departments and arranging the despatch daily of supplies, ordnance stores, remounts, reinforcements, and ambulance trains. Under him work, as before, three or four R.T.O.'s whose duties are limited to supervision of loading and entraining. From the figures given in the attached notes (*see* Appendix) you will see that I calculate on one train for each division as a minimum, add one or two ambulance trains for evacuating hospitals on the L. of C., supplies for army troops, occasional trains of forage, remounts, and ammunition, and the daily average will be not much under 12 trains a day, but to save time and engines probably two divisions' trains will be combined as one from the base as far as the regulating station.

So far as normal daily supplies are concerned the order of procedure is this :—Each division's train is loaded up each morning with its proper proportions of meat, fresh bread, groceries, etc. The loading of the supplies in such manner that, while loading economically, everything can be got at quickly and in proper order when unloading at railhead, will require very great care on the part of the A.S.C. officers and the R.T.O.'s. By mid-day the first train should get off followed quickly by the rest so that the last should reach the regulating station by five or six o'clock. I know that some supply

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officers would advocate loading up the trains on the previous evening so that they can be ready to start from the base early in the morning and reach railhead in the early afternoon. But if the aim is to give the troops fresh meat daily I anticipate that this will seldom be done in practice, unless refrigerator vans are available or unless the weather is cold. It would mean that the bread and meat will have been on rail and road nearly 48 hours from the time of loading at the base to the time of distribution to the troops. It would also add at least 50 per cent. to our requirements of rolling stock for supplies. This additional quantity might be of perhaps small importance if only ordinary open trucks were involved, but it would probably be a more serious consideration where refrigerator vans are required. I therefore think we shall have to endeavour to load supply trains on the morning of the day they are due at railhead.

At the regulating station we have another D.A.D.R.T. with one or two R.T.O.'s whose duty is to separate each division's train and send it on to its own proper railway supply station fixed that day by the I.G.C. in accordance with next day's rendezvous sent him from army headquarters. The trains should be at their supply stations by seven or eight o'clock at latest so that the mechanical transport supply columns can load up over night ready to be off to their rendezvous the first thing in the morning to meet the supply trains. This is the procedure to be aimed at, but it may be anticipated that individual divisions will make urgent demands too late to comply before trains leave the base. Therefore a small reserve, a sort of expense store, may be necessary at the regulating station. But adding or detaching trucks at the regulating station should be avoided by every possible means, it will mean delay—trains should be pushed straight through to the railway supply station. I anticipate that under this supply system the aim will be to get the rendezvous as near the troops as possible, and railway supply stations as near rendezvous as possible.

The distance from the rendezvous and the roads giving access thereto must of course govern the I.G.C.'s selection of railway supply stations. The other desiderata are a goods yard and siding where 13 or 14 lorries can get alongside the 15 supply trucks of the division. Except in station yards of large towns it will not often be possible to find more room than this. Therefore the 27 lorries of a division will have to load in two lots, half at a time, and allowing an hour for each lot to come alongside, load and get clear, that means two hours at least to load the lorries of the division. It follows that unless we can find large station yards where there is room for the railway trains of two divisions (*i.e.*, 30 trucks) to stand and unload simultaneously into two lots of 13 or 14 lorries each, we ought to have a separate supply station for each division. Probably it will not always be possible to find seven suitable stations, and therefore it seems

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probable that lorries will have to be prepared to load up late into the night, or in the early morning before leaving for their rendezvous. So long as the distance to be run by the lorries is short, some delay in off-loading trucks would not matter so much. But where the troops are 30 or 40 miles from railhead, as may often be the case, any delay to the lorries must be avoided by every possible means. Where there is only room at a station supplying two divisions for one train to stand, the other must be kept back at the regulating station, and timed to arrive when the first train has cleared.

All these are matters for the D.A.D.R.T. at the regulation station who must be prepared with the necessary information about all likely stations so that he can advise the I.G.C. as to the selection of stations.

There are certain points to which I would draw your attention in the assumptions made in connection with the concentration and supply.

First you may argue that with all the rolling stock of a large country at its disposal, the amount which I have shown on the attached notes as allotted to "Blue" is very small. But it must be remembered that "Blue's" ally is assumed to be concentrating at the same time and possibly requires a much larger quantity.

Secondly, it must be remembered that though the stock allotted to "Blue" is a very small fraction of the rolling stock of the country, yet the cattle trucks and vehicle trucks represent a considerable proportion of the numbers of that class of truck available. In fact more than three-fourths of the rolling stock of the country is useless to us for horses, guns and vehicles. Therefore I think that even though we are operating in a civilized country with even the largest and best equipped railway system, we shall always be limited in the rolling stock at our disposal and we must study to load it always up to its full capacity and not keep it standing idle for a moment.

You must also remember that the civil necessities of a large population require fulfilling in war almost as much as in peace. Take for instance London. Political considerations would not, I think, allow us to let London go hungry and its industries out of work. At present it is mostly supplied by sea. But suppose sea routes were closed or made too dangerous for merchant shipping. Immediately you will have to bring the food, fuel and industrial necessities of a large population by rail from Liverpool, Bristol and the west, throwing an enormous additional traffic on to the lines of concentration and supply of the army.

The conditions that I have mentioned in this instance will probably be found, in different shape no doubt, in many theatres in which we might be called on to operate, and therefore I do not think that we are ever likely to have unlimited use of railways in war.

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Once concentration is over, it is true that the ten or twelve trains required daily make but a comparatively small demand on a large railway system. But even these we shall have to keep down to the lowest limit possible, and if ever it is proposed to employ the railways for troop moves on any large scale, it will only be done after carefully considering how such movements will affect the supplies of the army or other important traffic.

It is also to be remembered that the ease with which the traffic can be handled will depend much on whether the lines of supply of the army follow the main lines of the country, or run athwart them, *e.g.*, generally speaking the capacity of English railways north and south is far greater than it would be east and west.

Troops for Railway Repairs and Reconstruction.

Assume now that beyond Potton and Royston the lines have been torn up in places, bridges destroyed and water supplies cut off. Here we shall have the regular R.E. railway companies at work mending the damage. We have at present three, but I regret to say that very shortly I believe we shall have only two. Their war strength as given in *War Establishments* is about 250 all ranks, so that we shall only have about 500 in all, and I have no doubt we shall have to supplement them whenever we can by civil labour, and probably R.E. works companies and other R.E. units may be called on to assist.

Repairs are essentially the duty of the R.E. railway companies. They are not intended to work the ordinary trains which supply the army. The trades of the men give a good idea of what they can do. They are roughly as follows :—50 carpenters, 50 fitters and smiths, 54 other artisans of different trades, 30 platelayers, 16 clerks, draughtsmen and surveyors, and 24 engine drivers and firemen.

We have you see a few engine drivers and firemen, but these will mostly be needed to run the trains of construction material required for repairs up to the front beyond the point where the ordinary civilian staff ceases working.

Whether we shall ever see the armoured train again in war I do not know—I am a little doubtful. But if we do, or if we want to run trains right out to the front for reconnaissance or to carry occasional supplies for advanced troops, the R.E. railway companies will probably have to provide the drivers and firemen.

Troops for Working Railway Traffic.

Now let us suppose that beyond Cambridge the railways belong to the enemy. The English staff will not work them, and the "Blue" army has to find its own means of working the trains, as it advances beyond Cambridge. Here I am afraid we are weak. We have at present no troops who can undertake such a job. We used to enlist

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in the Army Reserve railway men of the necessary qualifications from the principal railway companies of the country. These men did no colour service, but for purely railway work they were invaluable. Unfortunately, for reasons which I cannot go into, this reserve was allowed to dwindle till it has almost disappeared. There are, however, good reasons for hoping it will be revived very shortly and that we shall have a nucleus of about 300 skilled railway men, drivers, firemen, guards, signalmen, shunters, and other grades necessary to run the traffic of a line. Three hundred men certainly will not go very far, but they will enable us to make a start. At a rough estimate they might, assisted by the regular R.E. companies, enable us to run 10 or 12 trains a day over a line 150 miles long, and even that only for a limited time.

We can only hope that the army will not be called upon to work more than this at the first start, and we should have to supplement the 300 as far as possible with specially recruited civilian railway men.

POINTS TO BE CONSIDERED IN ARRANGING TROOP MOVES BY RAIL.

I have already mentioned the importance from a railway point of view of settling on the order of trains beforehand, and of not altering the order or composition of trains at the last minute. In dealing with civil traffic one passenger train is very like another ; troop trains are not. Therefore if ever it falls to you to arrange a large troop movement be quite sure of the numbers you want to go in each train, and do not try and alter their order or composition at the last minute, unless you have made sure that they are stabled so that you can do so without delaying matters.

Also, in notifying train arrangements to the troops you will find it necessary to give each train a number. Do not invent your own numbers but use the railway numbers. The railway people always give each train composition a number, and it makes for confusion if the railway people and the army are referring to the same train under different numbers.

Actual times of departure bear alteration more easily. On a well-organized line the actual times of running can be altered easily enough at any time up to the time the empty trains leave the place where they are stalled, and provided that all civil traffic has to give priority, as will generally be the case in war. But once the empty train has started for its entraining station it will probably be getting in the way of something else if you hang it up anywhere. But all time tables and arrangements, however good, depend for their smooth working largely on the troops themselves.

Rapid entrainment and detrainment is the crux of most large troop moves. Some very good advice on the subject is given in the *Field Service Regulations*, and on p. 151 of the *Field Service Pocket Book* which I do not propose to repeat.

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But I may mention one or two points which struck me at the recent Army manœuvres :—Getting vehicles on and off the trains was generally the longest job, and shipping or unshipping the wagon poles was one of the most fruitful sources of delay. Either the pin would not go in when detraining, or it stuck and would not come out in entraining. It is always worth while ascertaining at the entraining station, if possible, which side the horses will come out and at which end or how the vehicles will come off, 4-wheeled vehicles are very awkward things to push off backwards over a long row of trucks, and should be loaded so that they can be pulled and not pushed off. If you have to off-load backwards use drag ropes and allow only one strong man to steer the pole. Similarly, load horses so that they will come out head first. I know the books tell one to load them heads away from the other line of rail. But in my experience this does not matter, and in any case trains often have to be reversed during a journey and they may be heads inwards part of the way and heads outwards the rest. Also load heavy guns so that on arrival they are first to come off.

Of course these considerations cut both ways. Doing as I suggest may mean longer time in loading, but you can generally rely on having reasonable time to load, whereas you never know how long you may have to unload. Delays occur, trains get behind time and you may have to bundle out as quick as ever you can.

Lastly, I would suggest that a certain number of strong men in each battalion should be picked and practised beforehand in handling the loaded vehicles of the battalion, so that they become as handy with their vehicles as gunners are with their guns. And if a series of trains are to be dealt with it is of great advantage to have a permanent loading or unloading party to deal with all the trains of a brigade. They soon get quick at the work and know exactly what to do. A fresh party from each unit has to learn its work and the unfortunate R.T.O. has to repeat the process of instruction afresh for each train.

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APPENDIX.—R.E. RAILWAY UNITS IN WAR.

TRAINS REQUIRED FOR THE CONCENTRATION OF THE FORCE.

1 Cavalry division	= 73 trains.		
6 Infantry divisions	= 510 ,,		
2 Brigades M.I.	= 36 ,,	(approximate).	
Army troops	= 25 ,,	,,	
L. of C.	= 25 ,,	,,	
Total	= 669 trains.		

APPROXIMATE TOTAL QUANTITY OF ROLLING STOCK REQUIRED TO RUN 40 TRAINS DAILY FROM EACH PORT OF DISEMBARKATION.

Passenger coaches	380	Vehicle trucks	1020
Horse boxes	40	Brake vans	150
Cattle wagons	1200		

DISTANCES.

Bristol—Hitchin .. 150 miles. Birmingham—Sandy .. 90 miles.

NOTE.—For purposes of illustration, Birmingham is supposed to be a seaport.

DAILY REQUIREMENTS (NORMAL) AFTER CONCENTRATION.

Food supplies for one infantry division	= 67·6 tons.
,, ,, ,, cavalry ,,	= 69·2 ,,
,, ,, two mounted brigades	= 31·0 ,,
Petrol supply for mechanical transport of one division	= 350—400 gallons.

NOTE.—Daily supplies include corn but not hay. Gross weight of daily ration for men = 4·2 lbs.

AMMUNITION.

100 Rounds per gun for one infantry division	= 111 tons.
,, ,, rifle ,, ,, ,,	= 43 ,,

EACH INFANTRY AND CAVALRY DIVISION REQUIRES ONE TRAIN DAILY, CONSISTING OF :—

15 Trucks, supplies.
1 Truck, petrol.
1 ,, ordnance stores, etc.
1 ,, remounts.
1 Coach for details from base, and sick returning.
1 Brake van.

20 Vehicles.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

(*Continued*).

By MAJOR H. BIDDULPH, R.E.

THE SECOND MAHRATTA WAR, 1817–19.

This war was occasioned by the intrigues among the Mahratta rajahs, the lawless and anarchical condition of Central India, and the appalling depredations of the hordes of freebooters known as Pindarris.

The Governor-General, Lord Hastings, determined to suppress these marauders who had become a serious menace. Numbering nearly 20,000, and composed almost exclusively of mounted men, they moved with astonishing rapidity, committing the most unspeakable atrocities as they swept along, and at last they even dared to invade British territory. They were undoubtedly countenanced by some of the Mahratta rajahs, who received a portion of their plunder, and to meet the serious evils that had arisen, the Governor-General mobilized a force of over 100,000 troops, consisting of 13,000 European and 74,000 Native Regulars, 20,000 Irregular Cavalry officered by British officers, and 10,000 Native Irregulars. The artillery numbered 282 guns with the Regulars, and 13 with the Native Irregulars.

The combined military force of the Pindarris and those Mahratta rajahs who could not be trusted, totalled over 200,000 men with 589 guns; the mounted portion being no less than 130,000 of this total. As the event proved the British troops had to fight the principal Mahratta princes, as well as exterminate the Pindarris.

The British Army, drawn from every presidency, was brigaded on paper as follows:—

The Grand Army (Bengal Presidency).

C.-in-C.:—The Governor-General, Lord Hastings.
1st or Centre Division:—Major-General Thos. Brown.
2nd or Right Division:—Major-General R. S. Donkin.
3rd or Left Division:—Major-General D. Marshall.
Reserve Division:—Major-General Sir D. Ochterlony, G.C.B.

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The Army of the Dekkan (Madras and Bombay Presidencies).

C.-in-C. :—Lieut.-General Sir T. Hislop (C.-in-C., Madras).
1st or Advanced Division :—Lieut.-General Sir T. Hislop.
2nd or Hyderabad Division :—Brig.-General J. Doveton.
3rd Division :—Brig.-General Sir J. Malcolm, K.C.B., K.L.S.
4th or Poona Division :—Brig.-General L. Smith, C.B.
5th or Nagpore Division :—Lieut.-Colonel J. W. Adams, C.B.
Reserve Division :—Brig.-General T. Munro (Brig.-General T. Pritzler, 2nd in command).

The Goozerat Division (Bombay Presidency).

Major-General Sir W. T. Keir, K.M.T.

The fighting that occurred between November, 1817, and May, 1819, was of a most extensive and arduous character. The opening of the campaign was signalized by sudden attacks on the small British garrisons at Kirkee and Nagpore by the Regular troops of the Peishwa and the Bhonsla; while the Army of Holkar met its fate on the banks of the Sipra at the hands of Sir T. Hislop and Sir J. Malcolm in December, 1817. Numberless fortresses were besieged and taken, the Pindarris were exterminated, and the final crushing of the Mahratta confederacy effected at the cost of hard fighting and heavy losses.

The following notes will be confined chiefly to those events, which were commemorated in 1851 by clasps to the Army of India Medal, as follows :—

(i.). The Battle of Kirkee, 5th November, 1817, caused by the Peishwa's attack on the garrison of Kirkee.

(ii.). The Battle and Capture of Poona, 11th—16th November, 1817, when the Kirkee troops reinforced by Brig.-General L. Smith, defeated the Peishwa again and took his capital.

(iii.). The Defence of Corygaum, 1st January, 1818, when a detachment of all arms, 900 strong, held the village of Corygaum against the flower of the Peishwa's army, defeated with heavy loss every attack, and withdrew in good order and safety to Sirur.

(iv.). The Battle of Seetabuldee, 26th—27th November, 1817, where the small garrison of Nagpore, seizing the hills of Seetabuldee, withstood the sudden onslaught of the overwhelming forces of the Rajah and beat them off after a fight lasting 18 hours.

(v.). The Battle and Capture of Nagpore, 16th December and 24th—30th December, 1817. These events were the sequel to the Battle of Seetabuldee, in the same way as the Battle and Capture of Poona was the sequel to the Battle of Kirkee. It has to be

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recorded however with regret that the assault on 24th December failed, and that Nagpore capitulated on terms on 30th December.

(vi.). The Battle of Maheidpoor, 21st December, 1817, when Sir T. Hislop (with Sir J. Malcolm as 2nd in command) defeated Holkar's Army on the banks of the Sipra.

I. OPERATIONS NEAR POONA.

Troops Present at the Battle of Kirkee, 5th November, 1817.

Lieut.-Colonel C. B. Burr, 1-7th Bo. N.I., in command.

*Detachment H.M. 65th Foot.
3-2nd Battn. Bombay Artillery (4 guns).
Bombay European Regiment.
*The Resident's Escort (2 Companies N.I.).
2-1st, 2-6th and 1-7th Bo. N.I.
1st Dapuri Battn., with 3 field guns (Poona Auxiliary Force).
*Detachment of Pioneers.
Casualties :—19 killed, 67 wounded.

A wing of 2-6th N.I. with details was left in post at Kirkee. In a few days reinforcements arrived under Brigadier L. Smith, who attacked the Peishwa and captured Poona.

Troops Present at the Battle and Capture of Poona, 11th—16th November, 1817.

Brigadier L. Smith, 65th Foot, in command.

Right Wing :—Brigadier L. Smith.
H.M. 65th Foot.
*1st Troop Bo. Horse Artillery.
A Flank Battalion (formed from the N.I. regiments present).
*1-2nd, 1-3rd, and *2-9th Bo. N. Infantry.

Left Wing :—Lieut.-Colonel C. J. Milnes, 65th Foot.
Bombay European Regiment.
3-2nd Battn. Bo. Artillery.
The Resident's Escort (2 companies N.I.).
*2-1st, 2-6th, 1-7th Bo. N. Infantry.
Light Company 1-4th Bo. N. Infantry.

Also present, detachments of E and F Companies 2nd Battn. Madras and 3rd and 4th Companies Bombay Pioneers, and Corps of Poona Auxiliary (Irregular) Horse, under Capt. W. Spiller.

Casualties among the Regular troops, 15 killed, 79 wounded.

62 guns were taken.

* These corps sustained no casualties.

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Troops Present at the Defence of Corygaum, 1st January, 1818.

Whilst marching with a detachment from Sirur to strengthen the garrison of Poona, Capt. F. F. Staunton, 2-1st Bo. N.I., encountered the Peishwa's Army; seizing the village of Corygaum he held it against all attacks, and though heavy losses were sustained he succeeded in withdrawing his force by night in safety to Sirur.

Troops engaged :—

Auxiliary Horse (250 to 300 men).
Detachment G Company 1st Battn. Madras Artillery (two 6-prs., 25 Europeans and 18 Lascars).
2-1st Bombay N.I. (500 to 550 men).

Casualties :—

Madras Artillery :—13 Europeans and 5 Natives killed, 9 Europeans and 6 Natives wounded.
2-1st Bo. N.I. :—53 killed and 134 wounded.
Auxiliary Horse :—96 casualties.

Of the eight British officers present, three were killed and two wounded.

For their gallantry the 2-1st Bo. N.I. were constituted Grenadiers, and Capt. Staunton was made A.D.C. to the Governor-General, and presented by the H.E.I.C. with a sword of honour and 500 guineas; he was also nominated C.B. in due course. A monument was erected at the site in 1821 to commemorate the action, inscribed with the names of all who lost their lives in it.

II. OPERATIONS NEAR NAGPORE AND MAHEIDPOOR.

The small force at Nagpore, under Lieut.-Colonel H. S. Scott, was attacked suddenly by the Rajah's forces, while taking position on the two hills of Seetabuldee outside the town.

Troops Present at the Battle of Seetabuldee, 26th—27th November, 1817.

Lieut.-Colonel H. S. Scott, 1-24th M.N.I., in command.

Troops present :—

6th Bengal Cavalry (3 troops).
Detachment Madras Bodyguard.
,, Madras Artillery (from D Company, 2nd Battn., four 6-prs.).
Detachment Madras Pioneers, 1st Battn.
1-20th and 1-24th Madras N.I.
Residents' Escort (2 Companies N.I.).
Battalion Nagpore Subsidiary Force.

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Casualties.					Corps.	Field State 26th November, 1817.					
Natives.			Europeans.								
Missing.	Wounded.	Killed.	Wounded.	Killed.		British Officers.	Native Officers.	Other Ranks.	Recruits, Armed.	Recruits, Unarmed.	Recruit Boys.
—	22	22	2	1	6th Ben. Cav. . .	5	9	286	—	—	—
—	—	—	—	—	Bodyguard . . .	—	1	17	—	—	—
—	9	2	7	3	Artillery . . .	1	2	52	—	—	—
—	46	15	3	1	1-20th M.N.I. . .	12	11	429	80	—	64
—	98	56	4	2	1-24th M.N.I. . .	9	13	510	80	—	60
4	32	10	1	—	Escort . . .	3	3	173	—	—	—
—	13	8	2	—	Nagpore Battn. . .	4	11	13	70	392	—
—	—	—	—	1	Pioneers, Staff & Details	not given.			—	—	—

N.B.—At this period the Madras Bodyguard consisted of details borne on the strengths of the regiments of cavalry from which they were drawn.

The Resident's escort consisted of 2 Companies Bengal N.I. formed of volunteers from regiments quartered at Barrackpore. For its gallantry the 1-24th M.N.I. was restored to its old position and number, viz. : the 1-1st M.N.I. which it had forfeited for its mutiny at Vellore in 1806.

Battle and Capture of Nagpore.

The troops at Seetabuldee were relieved by the arrival of Brigadier J. Doveton's division, and on the 16th December, 1817, the Battle of Nagpore was fought in which 75 guns and 40 elephants were taken. Nagpore was then invested and an unsuccessful assault delivered on 24th December. Negotiations ensued and the fortress capitulated on 30th December.

Troops Present at the Battle of Nagpore, 16th December, 1817.

Brigadier J. Doveton in command.

Cavalry Brigade :—Lieut.-Colonel R. Gahan, 6th Ben. Cavalry.
Detachment Madras Horse Artillery (6 guns).
6th Bengal Cavalry.
6th Madras Cavalry.

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1st Infantry Brigade :—Lieut.-Colonel N. McLeod, 1st Foot.
H.M. 1st Foot (6 Companies).
1-12th Madras N.I., 1-22nd Bengal N.I. and Flank Companies 1-2nd Madras N.I.
2nd Infantry Brigade :—Lieut.-Colonel N. McKellar, 1st Foot.
1 Company H.M. 1st Foot.
2-24th Madras N.I.
Detachment Madras H. Artillery (2 guns).
3rd Infantry Brigade :—Lieut.-Colonel H. S. Scott, 1-24th M.N.I.
1 Company H.M. 1st Foot.
A, C, D Companies Madras Foot Artillery, 2nd Battn.
Detachment Madras Sappers and 1st Battn. Pioneers.
1-11th Madras N.I.
Detachment 2-14th Madras N.I. (1 officer and 70 men).

In support, 2-13th Madras N.I. from 1st Brigade. Principal Reserve Battery (from 2nd Battn. Madras Artillery, A, C, D Companies).

In rear, Berar Brigade (Artillery, Cavalry, and Infantry).—Major R. Pitman, 6th Bengal N.I.

With the baggage 1-20th and 1-24th Madras N.I.

Total casualties from 16th to 24th December inclusive, 94 killed and 348 wounded.

The above troops also effected the capture of Nagpore later on.

Troops Present at the Battle of Maheidpoor, 21st December, 1817.
(The Defeat of Holkar).

Lieut.-General Sir T. Hislop, C.-in-C., the Army of the Dekkan, in command.

Troops present :—
Horse Artillery Brigade :—Capt. H. T. Rudyard, Madras H.A.
1st and 2nd Troops Madras H.A.
Rocket Troop Madras Artillery.
Gallopers 3rd and 8th Madras Cavalry.
1st Cavalry Brigade :—Lieut.-Colonel J. Russell, 3rd Madras N.C.
1 squadron H.M. 22nd Light Dragoons (100 men).
3rd Madras Cavalry.
2nd Cavalry Brigade :—Major G. L. Lushington, 4th Madras N.C.
4th Madras Cavalry.
8th Madras Cavalry.
Artillery :—Major J. Noble, Madras Artillery.
D and E Companies 2nd Battn. Madras Artillery.
Russell Brigade Artillery.
Light Infantry Brigade :—Major H. Bowen, 16th Madras N.I.
Madras Rifle Corps (4 Companies).
1-3rd and 1-16th M.N.I.

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1st Infantry Brigade :—Lieut.-Colonel R. Scott, Madras European Regiment.

Flank Companies H.M. 1st Foot (7 officers, 161 men).

Madras European Regiment (5 companies, 9 officers, 314 men).

1-14th and 2-14th Madras N.I.

2nd Infantry Brigade :—Lieut.-Colonel A. M'Dowell, 6th Madras N.I.

2-6th Madras N.I.

1st and 2nd Battns. of Russell Brigade (Capt. A. Hare, 7th Bombay N.I.).

Detachment 22nd Bengal N.I. (16 men attached to Russell Brigade).

Madras Pioneers, 4 Companies 1st Battn. (B, E, F, G Companies). Capt. R. M'Craith, 22nd Madras N.I.

Mysore Silladar Horse, Capt. J. Grant, 5th Madras Cavalry.

Sir J. Malcolm's Escort (19 men of 6th Madras Cavalry).

Bhopal Contingent and Nizam's Reformed Horse.

Casualties :—

British Officers ..	4	killed and	34	wounded.
Europeans	19	,,	99	,,
Natives	151	,,	471	,,

N.B.—Over 200 of the wounded died subsequently, on account of the bad medical arrangements. 65 guns and 7 elephants were captured.

(i.). No other battles or sieges of the 2nd Mahratta War are commemorated by the Army of India medal clasps, though much additional fighting took place, some of which was very severe. The most noteworthy of these latter operations were (1) the Siege and Capture of Asseerghur in 1819, by Brigadier J. Doveton's and Sir J. Malcolm's divisions, the total casualties being 313. The regular troops engaged numbered over 15,000 and included H.M. 1st Foot, 14th Foot, 30th Foot, 67th Foot and the Madras European Regiment. When one recalls the fact that a clasp was authorized for the capitulation of this fortress to Colonel James Stevenson in 1803, when two men were killed and six wounded, the omission of this second successful siege is very curious.

(ii.). The Siege and Storm of Malleygaum in May, 1818, when the casualties were 208, including five British officers killed.

(iii.). The Siege and Storm of Nowah in January, 1819, when 200 casualties were sustained. It is to be noted that " Nowah " is borne as an honorary distinction on the colours and appointments of the Native corps engaged which still survive in the Indian Army (none of H.M. Troops were present) but it was passed over in silence in 1851. The Battles of Kirkee and Poona had a political value far outweighing their military character, and probably were commemorated on that account.

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Engineer Officers Engaged, 1817–19.

	Services.
Royal Engineers.	
Lieut. T. H. Elliot	A.D.C. to Sir T. Hislop. Battle of Seetabuldee. Battle of Maheidpoor (wounded). Capture of Talneir, 27. 2. 18. N.B.—This officer was on the staff of his father, the Governor of Madras, and was appointed by Sir T. Hislop to be his 2nd A.D.C. His presence at Seetabuldee was due to chance. It is uncertain whether he was present at the subsequent operations round Nagpore.
Bengal Engineers.	
Major T. Anburey*	Principal Field Engineer, 1st Division.
Capt. H. W. C. Smyth* ..	Field Engineer, 1st Division.
,, Rd. Tickell*	Field Engineer, 3rd Division. Capture of Mundla, April, 1818.
Lieut. J. Taylor	Assistant Field Engineer, 1st Division.
,, J. Peckett	Field Engineer, 3rd Division.
,, J. Cheape	Assistant Field Engineer, 3rd Division. Siege and Capture of Asseerghur, March—April, 1819.
,, J. Colvin	Assistant Field Engineer, 3rd Division.
,, A. Irvine*	Assistant Field Engineer, 1st Division. Siege and Capture of Asseerghur.
,, E. Garstin	Assistant Field Engineer, 4th Division. Capture of Nagpore, Capture of Taragarh, June, 1818, and Madoorajpoor, July, 1818.
,, J. F. Paton..	Adjutant, 1st Division.
,, W. J. O. Hall	Field Engineer, Nagpore (5th) Division. *Army of the Dekkan.*
,, G. Hutchinson*	Assistant Field Engineer, 4th Division.
Ensign T. J. Warlow	Assistant Field Engineer, 3rd Division. Siege and Capture of Asseerghur.

* N.B.—These five officers were engaged at the Capture of Fort Hathras, April, 1817.

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Madras Engineers.	Services.
Lieut. T. Davies	Siege and Capture of Nagpore (wounded), of Rajdeir, and of Trimbuck, April, 1818. Killed at Siege of Malligaum, 18th May, 1818.
,, J. Coventry..	Commanding Engineer at Siege and Capture of Asseerghur.
,, Alex. Anderson	Battle of Maheidpoor. Capture of Talneir (wounded). Siege and Capture of Chanda, May, 1818.
,, Alex. Grant	Siege and Capture of Singhur, February—March, 1818. Capture of Poorunder. Operations south of Kistna, Siege and Capture of Wassoota, Sholapur, May, 1818, and of Copal Droog, May, 1819.
Ensign J. W. Nattes	Siege and Capture of Nagpore (wounded), of Rajdeir and of Trimbuck (on the staff). Killed at the Siege of Malligaum, 29th May, 1818.
,, J. Purton	Battle of Maheidpoor, Capture of Talneir, Siege and Capture of Rajdeir, of Trimbuck, and of Malligaum (wounded), also of Asseerghur.
,, J. Oliphant	Siege and Capture of Nowah, January, 1819, and of Copal Droog, May, 1819.
,, J. J. Underwood ..	Siege and Capture of Rajdeir, Trimbuck and Malligaum (wounded).
,, E. Lake	Siege and Capture of Rajdeir, Trimbuck (wounded), Malligaum, Jilpy Amair, January, 1819, and Asseerghur.
,, J. Jenkins	With Doveton's division. Died at Akola, 4th December, 1817.
Bombay Engineers.	
Capt. J. Nutt	Operations near Poona, Siege and Capture of Singhur, Poorunder and Wassoota, March—April, 1818, as Commanding Engineer.
Lieut. T. Remon	Capture of Koaree (wounded), March, 1818.

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Bombay Engineers.	Services.
Lieut. J. McLeod	Operations near Poona, Siege and Capture of Singhur, Poorunder and Wassoota.
„ S. Atthill	
„ S. Slight	
Ensign W. M. Ennis	Killed, 13th November, 1817, at the outbreak of hostilities, whilst surveying near Poona.

The detail of the list of services is probably incomplete in a few cases.

THE 1ST BURMESE WAR, 1824–26.

Owing to the fact that special medals for this war were granted by the H.E.I.C. at its close to all the native ranks who served in it, both in Burma and in Arracan, etc., no native was eligible to the medal and clasp "Ava," when the Army of India Medal was granted in 1851.

The King's troops that served in the war were the 1st, 13th, 38th, 41st, 44th, 45th, 47th, 54th, 87th and 89th Foot. The Europeans in the Company's Service entitled to the medal and clasp "Ava" were the European officers, and N.C.O.'s of the Artillery and various corps, also the 1st Madras European Regiment. It was issued also to survivors of the Royal and Indian Navies, who served in the war.

The 1st Foot served at Nagpore and Maheidpoor also; and the combination of either of these clasps with that for "Ava" is met with; as also that of "Nepaul" and "Ava" for the 87th Foot, or "Maheidpoor" and "Ava" for the Madras European Regiment.

Beyond some of the officers, only two or three men of the 13th Foot served in Afghanistan 1839–42, who had previously served in the Burmese War.

The 44th Foot was destroyed at Cabul in 1842.

The combination in a group of the medals with clasps for "Chrystler's Farm" and "Ava" to men of the 89th Foot, is to be met with occasionally, as also of medals with the clasp for "Java" and clasps for "Assye," etc., to the 78th Foot. The combination of the two clasps "Ava" and "Bhurtpoor" is almost unknown.

300 medals with the clasp "Ava" were issued to the Royal Navy, and 46 to the Indian Marine. The vessels employed (many of them very small) were the following. List probably incomplete :—

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Royal Navy.	Indian Marine.
Alligator	Asseerghur
Arachne	Diana
Boadicea	Emma
Champion	Ernaad
Larne	Exeter
Liffey	Hastings
Slaney	Margaret
Sophie	Matchless
Tamar	Nereide
Tees	Pluto
	Sophia
	Teignmouth
	Trusty

A List of Engineer Officers Engaged.

Bengal Engineers.

Capt. J. Cheape.
Lieut. F. Abbott (wounded).
,, G. B. Thomson (with Brigadier J. W. Morrison's force, Arakan).
,, W. Dickson (wounded).
,, H. de Budé.
,, J. Tindall (Adjutant and Quartermaster).
,, J. Crommelin.

Madras Engineers.

Capt. J. Mackintosh (Chief Engineer, Invalided, 11. 8. 24; died, 22. 10. 24).
,, Alex. Grant (Chief Engineer from 21. 12. 24. Died, 20. 5. 25).
Lieut. G. A. Underwood (Chief Engineer from 21. 5. 25. Wounded).
,, E. Lake (Adjutant).
,, A. T. Cotton.

SIEGE AND STORM OF BHURTPORE, 10*th December*, 1825—1*st January*, 1826.

The Siege of Bhurtpore was occasioned by the usurpation of Durjan Sal, on the death of the Rajah.

Sir D. Ochterlony, the Resident at Delhi, began to take the necessary measures, which however were countermanded by the Government of India. The old veteran, distinguished throughout a long career by combined caution and daring in the field and wisdom in council, was so mortified by this rebuff that writing a dignified protest he resigned his post and died a few months later at Meerut. Meanwhile the state of affairs in Bhurtpore went from bad to worse, and the Government were compelled to retrace their steps and justify the measures which Sir D. Ochterlony had commenced, immediately

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after his death, and the Commander-in-Chief (Lord Combermere) undertook the siege in December 1825, with an army of 21,000 men, and a battering train of 112 pieces.

Lord Lake's disastrous failure in 1805 against this fortress was due to contempt of the enemy, insufficient preparations, a ridiculously small battering train, and an almost entire lack of engineers and equipment.

These faults were sedulously avoided on this occasion, and the fortress taken by assault after an enormous breach had been made by mining.

Troops employed :—

General Lord Combermere, C.-in-C.

Cavalry Division :—Brigadier J. W. Sleigh, 11th Light Dragoons.
1st Brigade :—Brigadier G. H. Murray, 16th Lancers.
H.M. 16th Lancers.
6th, 8th, and 9th Bengal L. Cavalry.
2nd Brigade :—Brigadier M. Childers, 11th Light Dragoons.
H.M. 11th Light Dragoons.
3rd, 4th, and 10th Bengal L. Cavalry.
Artillery :—Brigadier A. M'Leod.
Bengal Horse Artillery :—Brigadier C. Brown.
1st Brigade :—2nd Troop.
2nd Brigade :—1st, details of 2nd, and 3rd and 4th Troops.
3rd Brigade :—1st, 2nd and 4th Troops.
Bengal Foot Artillery :—Brigadier R. Hetzler.
1st Battalion :—2nd, 3rd, and 4th Companies.
3rd Battalion :—1st, 2nd, and 4th Companies.
4th Battalion :—2nd and 3rd Companies.
Bengal Engineers :—Brigadier T. Anburey.
6 Companies of Sappers and Miners, and 2 Companies of Pioneers.
1st Infantry Division :—Major-General T. Reynell.
1st Brigade :—Brigadier J. M'Combe, 14th Foot.
H.M. 14th Foot.
23rd and 63rd Bengal N.I.
4th Brigade :—Brigadier T. Whitehead, 41st B.N.I.
32nd, 41st, and 58th Bengal N.I.
5th Brigade :—Brigadier R. Paton, 18th B.N.I.
6th, 18th, and 60th Bengal N.I.
2nd Infantry Division :—Major-General J. Nicolls.
2nd Brigade :—Brigadier G. McGregor, 59th Foot, succeeded by Brigadier W. T. Edwards, 14th Foot, who was killed in the assault.
H.M. 59th Foot.
11th and 31st Bengal N.I.

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3rd Brigade :—Brigadier J. W. Adams, 4th Extra B.N.I.
33rd, 36th, and 37th Bengal N.I.
6th Brigade :—Brigadier W. T. Edwards, 14th Foot, succeeded by Brigadier C. S. Fagan, 15th B.N.I.
15th, 21st, and 35th Bengal N.I.

In addition the following troops were present :—

Two corps of Irregular Horse, Lieut.-Colonel J. Skinner, viz., the 1st and 8th Local Horse ; detachments from 1st Nusseeree and Sirmoor Battalions ; one wing 1st Bengal European Regt., which arrived on 9th January, 1826, and detachment of the 3rd Extra N.I.

The siege train, 112 pieces, arrived on 14th and 15th December.

Assault on 18th January, 1826.

Right Column :—Lieut.-Colonel J. Delamain, 58th B.N.I.	2 Cos. Ben. Eur. Regt. 58th B.N.I. 100 Gurkhas, 1st Nusseeree Battn.

Main Right Column :—Major-General T. Reynell.

Brigadier R. Paton	4 Cos. H.M. 14th Foot. 5 Cos. 41st B.N.I. 6th B.N.I.
Brigadier J. M'Combe	4 Cos. H.M. 14th Foot. 23rd and 60th B.N.I.
Reserve (Brig. T. Whitehead)..	2 Cos. H.M. 14th Foot. 18th and 32nd B.N.I.

Main Left Column :—Major-General J. Nicolls.

Brigadier W. T. Edwards (killed)	H.M. 59th Foot. 31st, 15th, and 21st B.N.I.
Reserve (Brig. J. W. Adams) ..	36th and 37th B.N.I.

Intermediate Column.

Lieut.-Colonel T. Wilson, 33rd B.N.I.	2 Cos. Bengal European Regt. Grenadier Co., 35th B.N.I. Light Co., 37th B.N.I. 100 Ghurkhas, Sirmoor Battalion.

Casualties at the assault :—

Europeans ..	81 killed.	303 wounded.	2 missing.
Natives ..	42 ,,	189 ,,	9 ,,

Total casualties during the siege :—
180 killed, 780 wounded, 20 missing.

Twelve British and one Native officer, present at this siege, had taken part in Lord Lake's unsuccessful siege in 1805.

The prize money amounted to nearly £500,000 sterling, of which the Commander-in-Chief's share was nearly £60,000, a lieutenant's nearly £250, a sergeant's £8, a private's £4, and a Sepoy's £2 14s.

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Three British artillerymen deserted to the enemy during the siege; and one of them who had served at Waterloo in the Royal Artillery was hanged on the N.E. Bastion after the capture of the fortress; the two others were transported.

Engineers (Bengal Presidency) Engaged.

Lieut.-Colonel T. Anburey, C.B., Brigadier.
Capt. R. Smith (wounded).
,, J. Taylor (wounded).
,, J. Colvin (wounded).
,, C. J. C. Davidson.
Lieut. W. N. Forbes (wounded).
,, A. Irvine, Brigade-Major (wounded).
,, E. Swetenham.
,, E. J. Smith (wounded).
,, H. de Bude (wounded).
,, J. Thomson.
,, J. Tindall (killed).
,, B. Y. Reilly.
,, G. T. Greene.
2nd Lieut. H. Goodwyn.
,, A. H. E. Boileau.

(*To be continued*).

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General Sir Harry North Dalrymple Prendergast, V.C., G.C.B., R.E.

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MEMOIR.

GENERAL SIR HARRY NORTH DALRYMPLE PRENDERGAST, V.C., G.C.B., R.E.

THE friends of Sir Harry Prendergast (and they are legion) must have been greatly grieved to hear that such a true friend and gentleman and grand and gallant soldier had passed away so unexpectedly on Thursday, 24th July.

He had attended the rehearsal of the ceremonial in connection with the Order of the Bath in Westminster Abbey on the Monday previous, in apparently excellent health. It now seems that he caught a chill in the Abbey on that day, and was unable to attend the final ceremony on Tuesday, 22nd. He was anxious to go to the Abbey on that day but was forbidden by his medical adviser. So little was thought at the time of his indisposition that at his urgent request several of the family attended the ceremony, and it was not till Wednesday that there was any serious alarm regarding his health. He then rapidly became worse and passed away on Thursday evening. He was loved and respected by all who knew him and never had an enemy, at any rate he never deserved one. He was a gentleman, true as steel and in every capacity of life, as a son, a husband, a father and a friend, was truly admirable. It may well be doubted if he had an unkind thought of anyone, and it is quite certain that if he had, he never expressed it.

The Prendergast family is a very old and distinguished one. Its records show a long list of warriors of note commencing with Sir Maurice de Prendergast, Lord of the Castle of Prendergast in Pembrokeshire (an Anglo-Norman knight who accompanied Strongbow in the invasion of Ireland, A.D. 1169). His grandfather was Sir Jeffrey Prendergast, Knt., of the Indian Army, who served from 1795 to 1835, and was present at the Siege of Seringapatam in 1799. He was afterwards A.D.C. and Military Secretary to Lord Harris, Governor of Madras, and in 1804 married Elizabeth, daughter of Hew Dalrymple, Esq., by whom he had four sons and a daughter. His second son, Thomas, entered the Madras Civil Service in 1825, married in 1827 Caroline, daughter of Marton Dalrymple, Esq., by whom he had two sons. First, Hew Lindsay, who served in the Madras Engineers and attained the rank of Major-General (d. 1892), and second, Harry North Dalrymple, the subject of this memoir.

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He was born in India on 15th October, 1834, was brought up in England, chiefly under the care of his grandfather, and was first educated in a private school at Cheam.

During 1849–52 he was at Brighton College and passed into the H.E.I. Company's College at Addiscombe in August, 1852.

On 8th June, 1854, he obtained a commission in the Engineers. At Addiscombe he was distinguished by his prowess in athletic sports, being an excellent cricket and football player; swift of foot and strong of arm he was second to none as a man-at-arms. From Addiscombe he went to Chatham and passed through the usual engineering courses, and was noted for his skill in boxing, fencing, etc.

In October, 1856, he landed at Madras, and was posted to the Godavery District but only remained there a few months as the B Company of Madras Sappers was ordered to proceed to Persia on active service and Prendergast was delighted to join them. They embarked at Coconada 19th January, 1857, arriving at Bushire in March. The company proceeded on board the Indian Navy s.s. *Victoria* with the 2nd Division of the Persian F.F. under Sir James Outram—up the Shat-el-Arab River to within three miles of the southern battery of Mohumera. On the 25th they were transferred to the s.s. *Hugh Lindsay*. The Indian naval squadron ran up the river until opposite the forts defending the channel leading up to Mohumera and engaged the batteries. The carronades of the *Hugh Lindsay* were worked by H.M.'s 64th Regiment, assisted by the Sappers. By 11 a.m. the enemy's batteries were silenced and the disembarkation of the troops was effected by 1.30 p.m. The Sappers landed and assisted the troops in their advance through the date groves, which were much intersected with channels. The bridge by which the artillery and cavalry crossed the main irrigation channel consisted of trees felled on both sides of the channel with a large Arab boat as a central support. The Persians retired precipitately, leaving their tents, etc., and stores, with a loss of 200 killed.

The Sappers returned to Bombay where they disembarked on 1st June, 1857. Sir James Outram greatly approved of their services and stated that they "had rendered the most efficient service in the expedition against Mohumera and during its occupation." The Indian Mutiny had broken out three weeks before its return and the Company at once volunteered with alacrity for service against the mutineers.

On the 16th June they marched for Aurungabad and joined the Deccan F.F. at that place under Major-General Woodburn, C.B., on 7th July. On 23rd July this force relieved Asseerghur and Mhow on the 2nd August, the Sappers having had frequent employment by the way in making roads passable, etc. During the monsoon they remained at Mhow, employed in strengthening the defences,

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but on 20th October they left for Dhar, Prendergast acting as Brigade-Major. This force was under Major Keane. They had a successful skirmish near Dhar and next day Dhar was invested. After a siege of a week, Dhar was occupied on 1st November. Major A. Boileau. R.E., was Commanding Engineer, and Prendergast was the next senior. The work was extremely hard. One tour of duty lasted 42 hours! From Dhar the field force marched towards Mundisore, and on 21st November encamped four miles south of that place. During this time Colonel Durand (who had charge of the Central Indian Agency and at that time was Political Officer with the force) had need of assistance with his correspondence and appointed Prendergast to this duty. The object Durand had was to relieve Neemuch, 30 miles north of Mundisore, and as but little was known of the state of the country a reconnaissance was ordered and Prendergast was sent with Capt. Mayne and 300 cavalry. Our picquets were driven in by a determined advance of the enemy, which however was checked by a charge of cavalry till the main body came up and subsequently defeated the enemy. Prendergast while gallantly charging with the cavalry was shot through the chest just to the left of the heart. On this occasion he saved the life of Lieut. G. Dew, of 14th Dragoons, at the risk of his own, by attempting to cut down a "Velaitee" who covered Lieut. Dew with his piece when only a few paces to the rear. It was on this occasion that he was wounded and he would probably have lost his life, had not the rebel been killed by Major Sutherland Orr, of the Hydrabad Cavalry.

The Malwa field force returned to Mhow by way of Mehidpore, Oujein and Indore in time to welcome Sir Hugh Rose at a Christmas banquet. At this time Sir Henry Durand offered Prendergast the post of Garrison Engineer at Mhow, but the offer was declined as he was keenly anxious for active military service. Sir Robert Hamilton now returned to his position in political charge of the Central Agency, Durand returning to Bombay and Calcutta.

Now commenced Sir Hugh Rose's brilliant campaign in Central India.

The 2nd Brigade to which the Sappers were attached marched from Indore on 8th January, 1858, through Sehore and Bhopal towards Saugor and reached Ratghur (on the Beema 30 miles from Saugor) on the 25th, and next day that place was invested. The cannonade was continued till morning of the 29th, then there being silence in the fort. Lieut. Chas. Strutt, Bombay Artillery, without orders, went forward followed by his gunners; the enemy's flag was hauled down and a Queen's Colour hoisted. Strutt was put under arrest for leading his men into peril, and so ended the Siege of Ratghur. On the 30th the Sappers occupied the fort and commenced to demolish the buildings. On 3rd February followed the Relief of Saugor after the officers and their families had been shut up in the fort for eight months. On the 8th,

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Prendergast was sent with half the company to blow up Nurrowlie Fort, 14 miles distant. Before sunset the mines were ready and having been exploded the men marched back to Saugor, thus doing a march of 28 miles and plenty of work besides. The next day they destroyed the fort of Sanoda some 10 miles to the east, and on the 11th batteries were commenced against Garrakotta (25 miles to the east) but during the night it was abandoned by the enemy. The fort was occupied and rendered unserviceable. The Sappers then marched back to Saugor and on towards Jhansi. On the 20th March a strong detachment of the 2nd Brigade advanced by a forced march of some 25 miles, placed picquets on all the chief roads round Jhansi, and next day Prendergast accompanied Sir Hugh Rose and Major Boileau, the Commanding Engineer, with cavalry and horse artillery, to make a reconnaissance. By the 30th arrangements had been made for storming the fort but the general action on 1st April with the so-called army of the Peishwa caused the assault to be deferred. The Battle of the Betwa ended in a complete rout of the enemy who lost over 1,000 men and all their 17 guns. The General and Capt. Prettejohn, 14th Dragoons, charged their right and left flanks and turned their position; the infantry dashed forward and put them to flight, while the cavalry and mounted officers charged through and through them.

"2nd Lieut. Prendergast, A.D.C. to the General, charged with Capt. Need's troop."

"The charge was equal to breaking a square, and the result was most successful, because the charge turned the enemy's position and decided in a great measure the fate of the day." Prendergast was severely wounded on this occasion, having received several sabre cuts on his left arm and the thumb of his left hand was all but severed.

On the 3rd April Jhansi was stormed with success but our loss was very heavy—Lieuts. Dick, Meiklejohn, and Bonus, of Bombay Engineers, led the way. Dick was bayoneted and shot dead; Meiklejohn was cut to pieces and Bonus was hurled down, while Lieut. Fox, of the Madras Sappers, was shot through the neck. The next few days a great deal of street fighting took place and it was not till the 6th April that Jhansi was completely ours. On the night of the 4th the Rani of Jhansi fled. The cavalry were sent in pursuit and cut up some 200 of the rebels. While at Jhansi Prendergast and Fox, of the Sappers, were invalided but the difficulty was to get away.

On the 25th April the 1st Brigade marched for Calpee and the officers of 86th invited the two wounded men to go with them in their "dhoolies," so they started, but at the end of the first day the brigadier observed them and insisted that they should return to Jhansi, as nothing would persuade him that marching east from Jhansi was the shortest way to Europe. A short time after this Lieut.

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Dick, of the 3rd Bombay Cavalry, halted at Jhansi with a large convoy and offered to take them to Sir Hugh Rose's camp. And the following day they camped with the Sappers of Rose's force and marched with them to Golowlee, near Calpee, on the 15th May. On that day the rear guard was attacked and every day till 22nd the enemy gave us no rest.

From Calpee Prendergast and Fox were sent to Cawnpore and after halting there a few days went on by dâk gharries to Calcutta, when Prendergast went home on two years' leave. While in England he received his decoration of the Victoria Cross, from the hands of Her Majesty at Windsor.

Hearing of the proposed expedition to China he volunteered to proceed with it but was refused permission to go out to India.

Again when in 1859 Austria fought against Italy and France he travelled to Vienna to endeavour to serve with them but was again disappointed.

On return to India he served for a few months as Assistant Engineer in P.W. Department at Vellore under his brother Hew Prendergast, who at that time was District Engineer of North Arcot. Thence he was transferred to the Raidroog Range of the Bellary District where he was employed in looking after roads and irrigation works. After some time there, he was sent to St. Thomas' Mount (the headquarters of the Madras Artillery) where he had charge of military buildings, besides irrigation works in the neighbourhood under Capt. Frank Moberly, R.E. While at Bellary he had passed the departmental examination in Telugu with credit.

During his stay at the Mount a Camp of Exercise was proposed at Lahore (they were a novelty in those days) and he, ever anxious to gain experience of military affairs, applied for six months' leave to attend it. He was granted the leave but before he could avail himself of it the camp was changed into a campaign against Umbeyla under Sir Neville Chamberlain.

On the 20th November, 1863, Lord Elgin, the Viceroy, died and Sir William Denison, the Governor of Madras, went to Calcutta as Acting Viceroy and he invited Prendergast to accompany him. He visited Agra, Delhi, Lucknow, Benares, Allahabad and Cawnpore, but the campaign against Umbeyla was over before he could reach headquarters. He however met Sir Hugh Rose (then Commander-in-Chief) the day after the affair at Shahgudi and had the opportunity of seeing something of frontier life. Soon after his return to Madras, he was appointed Assistant Consulting Engineer for Railways, which post he retained till 1867, when he sailed from Beypore in command of three companies of Madras Sappers for service in expedition to Abyssinia under Sir Robt. Napier. They reached Annesley Bay in January, 1868. He was Field Engineer during the advance, was present at the action at Arogi before Magdala and at the capture of

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that fortress when King Theodore died by his own hand. Prendergast was mentioned in despatches as "having rendered singularly valuable and important services."

He had obtained his Brevet Majority in April, 1863, for his services in the Central Indian Campaign in 1858, and now in August, 1868, he received his Brevet Lieut.-Colonelcy for his services in Abyssinia.

On return from Abyssinia he reverted to his duty as Deputy Consulting Engineer for Railways, but after some months he was appointed to the command of the Madras Sappers (7th January, 1869) and this command he held for nearly 12 years, having during the interval been on furlough to Europe for two years from May, 1874, during which time his brother, Major Hew L. Prendergast, officiated for him.

During his command of the Sappers he was appointed C.B. for his services (29th May, 1875), and in March, 1876, in commemoration of the visit to India of H.R.H. the Prince of Wales, Her Majesty the Queen was graciously pleased to appoint H.R.H. Honorary Colonel of the Madras Sappers, and in addition conferred on the regiment the distinction of being styled "The Queen's Own" and wearing on their colours and appointments the Royal Cypher within the Garter.

In April, 1878, Lord Beaconsfield resolved to despatch a force from India to the Mediterranean ; 7,000 men were ordered to embark at once, and Prendergast was entrusted with the command of four companies of Madras and Bombay Sappers. After nearly a month at Malta he was ordered to proceed at once to Cyprus with the Sappers and ordnance stores, to land at Larnaca and select a camping ground for Lord Wolseley's force. They arrived at Larnaca on 16th July. The siege train was landed by the 19th ; landing stages were constructed for the expected troops ; a pier was commenced with the assistance of the navy under H.R.H. the Duke of Edinburgh, and a camp was selected at Chifflek. There were but eight days to do this and when required the Sappers could show six piers ; a road to the camp ; water supply troughs at the camp and carriage enough to take the regiments on as they landed. At first Prendergast was the senior engineer officer and would in ordinary course have been C.R.E., but Lieut.-Colonel Maquay was sent out from England and being about six months' senior to Prendergast (although two years younger) became C.R.E., and so he returned to India on 25th August, although the companies of Sappers did not leave Cyprus till 1st November, reaching Bombay on the 20th. Lord Wolseley recorded "his sense of the valuable work they had done."

During the Governorship of the Duke of Buckingham for a short time he acted as Military Secretary to the Government. At this time Sir Neville Chamberlain was Commander-in-Chief, and when he was sent on a special mission to Kabul, General Elmhirst, in command of the Mysore Division, became Provincial Commander-in-Chief.

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Sir Neville was stopped in the Khyber Pass. War became imminent with Afghanistan; and it was arranged to send a force to Kandahar under General Primrose, and Prendergast was named Commanding Engineer to the division. He afterwards sent companies of Sappers up to the Khyber and put his own name down on the list of officers, but it was struck out as he had been nominated to Primrose's force.

The staff of Primrose's division was not after all made up as at first intended, and Prendergast in consequence missed the first phase of the war; and when the second began he had just started for England to recruit his strength, and although he returned within three months he was too late to join in it.

In 1880 he was appointed Brigadier-General in command of Malabar and Canara with headquarters at Cannanore, and from thence in 1881 he was transferred to the command of the ceded districts at Bellary.

In the autumn of 1882 (16th September) he was promoted Major-General and had to vacate the brigade command. Sir Frederick Roberts, Commander-in-Chief at Madras, invited him to take up the duty of Q.M.G. at once so he joined him in that capacity at Secunderabad. Early in 1883 he was released from duty as Q.M.G. with the view of having a few months' leave in England before taking command of the Burma Division, which he assumed in April, 1883.

There was an idea that war with Upper Burma was imminent but nothing was known for certain. Prendergast with the Chief Commissioner (Sir Chas. Crosthwaite) visited Thayatmyo, rode along the frontier to Mendoon and also went to Minhla and other places; the result being that when war broke out, he knew more of the country than any of his officers.

From Burma he was summoned to the Camp of Exercise at Bangalore in January, 1884, and commanded the 2nd Division. Sir Frederick Roberts, C.-in-C., was present, also Sir Donald Stewart, C.-in-C., India, as well as Sir Arthur Hardinge, C.-in-C., Bombay, and Sir M. E. Grant-Duff, Governor of Madras, was at the flagstaff during the last march past. Prendergast was very successful in his movements and operations at this camp, and he was offered the command of the Hyderabad Subsidiary Force; but returned to Burma for a few months with the desire of being present in case war should be declared. However when there seemed no chance of a campaign he was very glad to be transferred to Secunderabad. Here he had more camps of exercise. While in this command he received an autograph letter from the Viceroy, Lord Dufferin, telling him that he had been selected to command the Burma Expeditionary Force.

On arrival at Rangoon, 7th November, 1885, he was received by Mr. (after Sir Charles) Bernard, the Chief Commissioner, and had a few days to inspect the troops, steamers, etc., and complete final

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arrangements before advancing. A force of 3,000 British and 6,000 native troops had to invade and hold a country larger than France, which was to be administered by means of a Political Officer (Colonel Sladen) and four or five assistants, but Prendergast was entrusted with full political powers, Colonel Sladen being his Political Assistant. The fine fleet of the Irrawaddy Flotilla Company was engaged to convey the force up the Irrawaddy and took the troops from Rangoon to Thayatmyo (the British frontier port) under the guns of which it was proposed to assemble the flotilla.

On the evening of the 12th November Prendergast left Rangoon by rail for Prome, and embarking the following morning reached Thayatmyo on afternoon of the 13th. The next day the King of Ava's steamer with its attendant barges was captured near Nyoung-ben-Maw and brought away. On the 16th everything being ready the steamers weighed anchor at daybreak and by 9.15 a.m. a landing had been effected at Zoung-gyen-Doung, two miles below the batteries.

On the 17th it was resolved to attack Gue-Gyoun-Ramyo on the left and Minhla on the right banks simultaneously. Both attacks were successful.

The next day the Expedition halted and arrangements were made for holding the fort where 17 guns were captured.

On the 24th the fleet proceeded to Yandaboo where the treaty of 1826 had been signed.

On the 26th at 8 a.m. the fleet left Yandaboo and at 4 p.m. near Nazoon a Burmese State barge with a flag of truce was observed—this proved to contain two of the king's envoys. These two envoys had an interview with General Prendergast and his Assistant, Colonel Sladen. The envoys left with a reply at 6 p.m., and while the interview was taking place the fleet advanced, so that the envoys had the advantage of seeing the whole of the troops file past. The fleet anchored 7 miles below Ava, and as no answer had been received from the king, orders were issued for the attack of Ava, but at 10.30 when the proposed landing place was in sight, some envoys came on board and brought unconditional acceptance of the terms imposed. The Burmese troops at Ava were disarmed, and on 28th the fleet left Ava at 6.30, reached Mandalay at 10 a.m., and an hour later a letter was sent demanding the surrender of the capital as well as King Theebaw. Troops were landed at 1.30 p.m., marched at 2 p.m. At the five gates the guards were disarmed, and the advance continued to the palace (4 miles off) which was surrendered and its four gates occupied.

Colonel Sladen had a long interview with the king, and about 5 p.m. he informed General Prendergast that the king had unconditionally surrendered himself and his kingdom, and would do so personally to General Prendergast next day.

On the 30th King Theebaw surrendered, and at 3.30 p.m. the king

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with his queens and attendants left the palace. By 6.15 p.m. they were all on board the *Thooreah*, and next morning the vessel left for Rangoon.

On the 1st December the city was ordered to be disarmed. Many arms were given up, the gun factory taken possession of, as well as the powder factory, and guards were placed over them ; the elephants belonging to the king were brought in, and tranquility was established in the city.

On the 10th December a great number of congratulatory telegrams were received, and General Prendergast was informed that the distinction of K.C.B. had been conferred on him. The Viceroy also telegraphed " I am commanded by Her Majesty to express to you her warm thanks and her admiration at the skill with which you have conducted the whole Expedition."

On the 6th December a brigade was detailed for Bhamo (250 miles above Mandalay) as it seemed expedient to General Prendergast to garrison that important place without delay.

On the 19th he left Mandalay. Next day having joined the vessels containing General Norman's brigade, they steamed northwards, and on the 27th the flotilla anchored 10 miles below Bhamo.

Next day Bhamo was occupied, and the ambitious projects of China were quashed. This expedition was ordered on the initiative of General Prendergast himself, and on his sole responsibility. In a very few days General Norman was firmly established at Bhamo with his guns—four 25-pr. R.M.I. guns, two howitzers, and six mortars.

All this being secured Sir Harry Prendergast returned to Mandalay on the 12th January, 1886, and a month later the Viceroy, Earl of Dufferin, accompanied by the Countess, and the Commander-in-Chief, Sir Frederick Roberts, entered Mandalay.

Before leaving on the 18th February the Viceroy announced that the kingdom of Ava had been incorporated with Her Majesty's Empire.

In the Queen's Speech on the 21st January, 1886, when Parliament was opened by Her Majesty in person (the speech was read by the Lord Chancellor, Lord Halsbury), it was remarked " Through the gallantry of my European and Indian forces under General Prendergast the country has been rapidly subjugated," but strange to say the British Parliament did not so much as thank the army and its victorious Commander who overthrew the dynasty of Alompra and added a rich province, equalling France in area, to the British Empire. This may perhaps have been due to the defeat of Lord Salisbury's Government very shortly after, by which on the 6th February, 1886, Mr. W. E. Gladstone became Prime Minister till the 3rd August following.

On the 18th February the commands in Burma were reconstructed, Sir Harry Prendergast being placed in command of the whole of Burma from Rangoon to Bhamo, with Brigadier White at Mandalay,

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and Brigadier Norman at Bhamo. Sir Harry left Mandalay on the 23rd February, spent a few days in Rangoon, and again reached Tonghoo on 6th March, and went thence to Mingyan and Yemethen with reinforcements, Hlinedat was occupied and by the 10th March no hostile force was near Yemethen. He then returned to Rangoon by the 25th March when he learnt that he was to lose the command he held simply because he had in the meantime been promoted Lieut.-General.

After the end of March, 1886, Sir Harry Prendergast was unemployed in a military capacity although he was a thorough and very successful soldier of very large experience. At that time he was in the prime of life being only 51 years of age.

Sir Harry Prendergast after brief visits to Madras and Secunderabad, at both which places banquets were given in his honour, left for Europe. On arrival in England he was invited to the Mansion House and most of the great City Guilds sent him invitations.

On his return to India he went to Ootacamund and lived there for more than a year out of employment. At last the Governor of Madras offered him the officiating appointment of Resident of Travancore and Cochin. After a few months there he was transferred to Mysore as "Resident." Sir Harry had known the Maharajah as a boy and found him a perfect gentleman. Sir R. Sheshadri Iyer was the Minister and an old friend, Colonel Chas. Bowen, R.E., was the Chief Engineer and Secretary to the Government, P.W.D. He was next transferred to Baroda and found the Guikowar a remarkably intelligent statesman. From Baroda he went to Beluchistan to act for Sir Robert Sandeman—a strong man who knew Beluchistan and its people well. While there Prendergast settled a quarrel between the Mirzais and Achakzais in the Zhob Valley.

From Beluchistan he returned to Baroda and after some time was again sent to Mysore to succeed as Resident on the death of Sir Oliver St. John, K.C.S.I. He held this post till 1892, and while there visited the Coorg territory of which he was Chief Commissioner. He returned to England in 1892 at the age of 57, and from that time up to his death he remained without Government employment.

His rapid promotion was by no means of great benefit to him. He became a Brevet Colonel when 40, he was Major-General 16th September, 1882, and on 22nd February, 1887, became General when only 52. He thus in the very prime of life attained a rank which precluded him from holding any but the very highest military appointments, and as a result a splendid soldier was laid on the shelf owing to his having distinguished himself so frequently. It is a matter for regret that his fine qualities could not be fully utilized and that he never held the highest command, for which he was most admirably qualified in every way.

On the 26th June, 1902, he was promoted to be a Grand Cross of the

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Bath, but this was 16 years after he was made a K.C.B. for his highly successful campaign in Burma.

During the South African War he volunteered for service and patriotically offered to waive his rank if they would give him a command. His offer was not accepted.

I have many letters from his friends which are unanimous in extolling his character, but to sum up his eminent qualities I cannot do better than give an extract from the *Madras Mail* of 16th April, 1892, which seems to me to have been written by a man who was well acquainted with him and thoroughly appreciated his grand qualities. It was written when Sir Harry Prendergast was on the point of leaving " the land of regrets " behind him.

"To sum up I may say that Sir Harry Prendergast is a notable specimen of that type of soldier in which we conceive our own nation to be particularly strong. Essentially a man of action, his actions have ever been free from the slightest trace of self-seeking or personal aggrandisement. With a valour, energy and courage of the highest possible kind, he has invariably subordinated self to the best interests of that Empire which is proud to own him as a son. With such great spirits as Outram and Havelock, Stewart, Hugh Rose and Robert Napier for his Captains, he has now by a long, honourable and brilliant record of battles, sieges, fortunes, disastrous chances, moving accidents by flood and field and hairbreadth escapes in the imminent deadly breach become a great Captain himself, and in bidding him farewell I cannot but recall the eloquently simple words Sir Hugh Rose used when he wrote of him in despatches after the Battle of the Betwa when he 'thanked Lieut. Prendergast for his courage and gallantry as devoted, as they were unostentatious.'

The courage and gallantry are as strong, as high now as in the days of yore, and high rank, much fame and many honours have not served to obscure the simple modesty, the unostentatious character of the grand old soldier whose name is a household word not only in Madras but all over India.

Honour, love, obedience, troops of friends—all these Sir Harry Prendergast has, and not the least of his many virtues is that he has richly merited them all—and that he may continue to enjoy them all for many, many years to come is the hearty wish of everyone who knows him."

The writer of this brief memoir knew him well and can emphatically endorse the opinion thus expressed regarding him and is greatly grieved that all must now be taken in the past tense.

In 1864 he married Emilie, daughter of Frederick Simpson, Esq., and niece of General Geo. W. G. Simpson, of Madras Artillery, who was at that time Superintendent of the Gunpowder Factory in Madras. By her Sir Harry had four sons and four daughters but of these only two sons and three daughters survive.

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The funeral took place with military honours in Richmond Cemetery on Monday, 28th July, and quite remarkable crowds gathered in the streets to show their respect for a brave and distinguished soldier who had fought nobly and well for the British nation. The gun-carriage left Heron Court at 3 p.m. The band of the Royal Military School of Music led the procession to the music of the Dead March in "Saul." The gun-carriage was drawn by a team from the 19th Hussars. Seven mourning coaches followed and then four open carriages full of beautiful wreaths and crosses.

Soldiers from the Royal Engineers bore the coffin into the Richmond Parish Church where it was met by the Vicar of Richmond and five other of the clergy including the veteran missionary Dr. Marks who spent many years in Burma, the country the deceased general won for the British Crown. There was a large congregation in the Church, including many of his intimate friends. After the service in the Parish Church the procession moved slowly to Richmond Cemetery and all the way passed through lines of people. On the way to the cemetery the music of Chopin's funeral march added solemnity to the scene. A large crowd had gathered near the grave. The Committal rites were read by the Vicar, and then from six silvery-toned bugles the soldier's last farewell "The Last Post" rang out. This was the most pathetic moment of all, as the pure clear tones of this requiem floated out across the quiet hillside cemetery, and when the last mournful note died away, there was that stillness which only comes to a crowd in moments of emotion.

HENRY M. VIBART,
Coloncl, R.E. (rctd.).

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REVIEWS.

BUILDING SUPERVISION.

By GEORGE W. GREY.—(E. & F. N. Spon, Ltd., 57, Haymarket, W. 2s. 6d. net).

THIS book is written chiefly for the benefit of a Civil Clerk of Works, to assist him in his dealings with not too scrupulous contractors. It may therefore be of some use to a Military Foreman of Works, though much in it is of a very elementary nature. The chapters on cement and concrete are clear and up to date.

C.R.S.

MOLESWORTH'S POCKET BOOK OF ENGINEERING FORMULÆ. (27th Edition).

(E. & F. N. Spon, Ltd., 57, Haymarket, W. 5s. net).

THE "Jubilee" edition of *Molesworth* contains all the data which have made previous editions indispensable to engineers of every branch, together with sixty pages of new matter. The additions include sections on factory chimneys and aeronautics, and a considerable increase in the Electrical Supplement. The size of the book is not noticeably increased, and it will continue to be one of the books every Sapper officer will take with him on service.

C.R.S.

PORTLAND CEMENT: ITS MANUFACTURE, TESTING AND USE.

By D. B. BUTLER.—(3rd Edition. 1913. E. & F. N. Spon, Ltd., London. 16s. net).

THE new edition of this standard work contains details of the modern manufacture of Portland cement in all parts of England. Full descriptions are given of the modern "Semi-wet" method of mixing of the raw materials, and of the modern standard method of calcining the mixture in rotary kilns. The section on testing contains a description of the various tests required by the latest British Standard Specification, together with several alternative tests in some cases preferred by the author. In an Appendix are given in full the British, German, French and American Standard Specifications; and the whole forms a very valuable book of reference.

C.R.S.

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THE AIRMAN: EXPERIENCES WHILE OBTAINING A BREVET IN FRANCE.

By CAPT. C. MELLOR, R.E.—(John Lane. Price 3s. 6d. net).

CAPT. MELLOR is to be congratulated upon his interesting little book *The Airman*, which gives his experiences while obtaining a brevet in France. Not only will it prove most useful to anybody who wishes to qualify for an aviation certificate, but it is also most interesting to the general reader.

In successive chapters Capt. Mellor gives his reasons for deciding on learning in France, and the advantages or disadvantages of the various schools. He then describes the course of instruction, the tests to be passed and the difficulties to be overcome. In his chapter on "Subsequent Practice" he gives a most interesting description of how he learnt "on his own" the *vol plané*, which would seem to show how well he had mastered the difficulties of flying, even though he had only 7 hours and 2 minutes "actual flying time" before he secured his certificate.

NOTICE OF MAGAZINE.

RIVISTA DI ARTIGLIERIA E GENIO.

May, 1913.

JAPANESE IDEAS ON COMBATS AROUND ENTRENCHED POSITIONS.

Each year, during the great manœuvres in Japan, special exercises are practised for the benefit of the pioneers, in which two or three battalions of these troops take part together with detachments of the other arms. From these they generally proceed to the attack and defence of an entrenched position. The Inspector-General of Instruction, and the Inspector of Pioneers assist at these exercises, and at their termination communicate their observations to the several territorial commands of the army, by whom they are brought to the knowledge of the troops. The exercises take place generally in the months of February, March and April, and are frequently practised on cold and rainy nights which are favourable for such manœuvres, and which accustom the troops to fatigue and hardships similar to those of war.

The recruits—who in Japan are enrolled on the 1st December—do not take part in these exercises. The mixed detachments which participate are formed of two or three battalions of infantry, one or two squadrons, two or three batteries, and two companies of pioneers; the various services are also represented, as the Japanese always maintain that whatever may take place in war should have been previously learnt and practised in peace times.

The general principles of the attack and defence of an entrenched position are identical both in the German and Japanese regulations, but in their application there are certain differences. The Japanese

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regulations prescribe that the defence should be reinforced with only one line in the most efficacious manner and with every means at its disposal; but in some circumstances a tendency is shown to fortify two successive lines and to construct works in other positions. The idea of long continuous lines of defence is stated to have been completely abandoned, and only the constitution of centres of resistance is admitted.

The instruction in field fortification gives rules for the construction of redoubts for battalions and of trenches for companies, and attributes great importance to the reciprocal flanking of the works. The Japanese field artillery also makes greater use than that of the Germans of concealed and semi-concealed positions, and advocates the construction of deep retrenchments, concealed from the enemy's view, so as to avoid the raising of dust. The profiles used for the trenches, covered defences, and trenches of communication, are of various forms not fixed upon beforehand and depending upon the nature of the soil and the time at disposal. Great importance is also given to the construction of defences with sandbags, or bags filled with earth in cases where the ground is not suited for excavations. In the scarps of the trenches there are numerous ramps to facilitate passages for the counter-attack. The mitrailleuses have also the duty of providing for the flanking defence, and are generally installed in the extreme salients of the lines of fire. Near to these, searchlights are placed in such a manner as to light up, during the night, the objects to be fired upon.

In the Japanese instruction great importance is given to the location and construction of obstacles; the experience of the war shows that the most efficacious obstacle is iron wire netting of a width of about 10 m. placed from 20 to 30 m. in front of the lines of fire. Across the wire netting narrow zigzag passages are left for the patrols which can be closed against the enemy in time of need by means of *chevaux de frise*. Land torpedoes are placed both in front and behind the barbed wire network.

In addition to the requirements of ordinary tactics the Japanese instructions also provide for hygienic conditions. The drainage of water from the trenches is thoroughly attended to; in the interior of the entrenchments the ground is covered with straw, and during the coldest season coal and wood fires are lighted. The latrines are kept with the greatest cleanness.

The Japanese regulations prescribe that the fortification works should be constructed simultaneously along all the lines of defence, and that they should be carried on with vigour and without interruption. The pioneers are employed on special works, such as the construction of covered trenches, obstacles, etc. The rules for the conduct of the attack of a fortified position are treated with the greatest care. The reconnaissances should be made with numerous patrols of officers of infantry and pioneers; they should be made for the most part at night. The infantry patrols should specially reconnoitre the ground for the attack, and those of the pioneers the adversary's positions. For the protection of the exploring patrols, the infantry should advance either in close or open order according to the nature of the ground, in complete silence, and guided by signals from white flags or concealed lanterns.

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At a short distance from the position selected for the attack, the troops should be closed up and all should extend themselves on the ground. The commanders of the columns and of the groups should creep forward to obtain the position which is considered favourable for explaining the fire action.

The disposition of the troops and the alignment of the trenches is immediately marked out with strips of white linen or with chalk, then the several commanders having left at the post certain indications, return to their troops and bring them to the position. On their arrival the construction of the trenches is at once commenced. While the attacking infantry proceeds to occupy these first posts, the artillery takes up new positions.

The difference between the ideas of the Germans and the Japanese arises in the organization of the attacking infantry, in the strength of the detachments for the occupation of the positions, and in the nature of the fieldworks. In the German regulations it is laid down that the attacking infantry should strive to push forward close enough to the defenders in such a manner that the position selected for opening fire can at the same time be considered as assaulting positions. The Japanese, with their war experience, do not consider such a rapid advance possible. Their regulations state that it is not possible to approach to a position fortified with fieldworks in any other manner than by constructing a series of successive positions of attack. And in their military literature the idea is expressed that *the assailants should accustom themselves to consider their fieldworks as a shield that they carry in front of them, and that in the operations around fortified positions they should not by the use of the spade allow the offensive spirit to be in any way lowered.*

E. T. THACKERAY.

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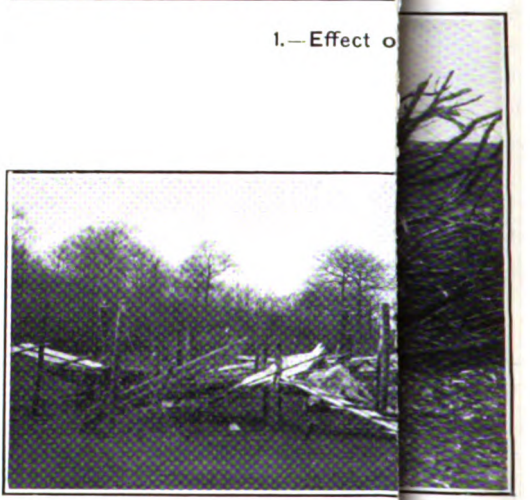

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DESTRUCTION AND CROSSING OF HIGH WIRE ENTANGLEMENTS AND ABATIS.

By MAJOR R. N. HARVEY, D.S.O., R.E.

THE following is a description of some experiments in the destruction and crossing of high wire entanglements and abatis, which were conducted recently at Chatham. It is not claimed that the methods tried are the only ones and the best. On the contrary some of them are of very doubtful practical value. The study of the destruction or surmounting of obstacles is one which must be of great interest to all R.E. officers, and it is hoped that experiments will be carried out by all units, so that when the R.E. are actually called upon to take up the duty there may be some definite knowledge to work on.

HIGH WIRE ENTANGLEMENT.

The high wire entanglement was 58 yards long and 8 yards deep and of the irregular type as shown in *M.F.E., Plate* 22.

1. *Demolition by a Dynamite Torpedo.*—The torpedo consisted of a tin tube 24 ft. long with an interior diameter of 2½ in., sufficient to take four 2-oz. dynamite cartridges tied together in a bundle. These 8-oz. bundles were pushed into the tube by a long wooden rammer. The bottom end of the tube was closed by a pointed wooden plug with handle. This plug was grooved to take a 2-oz. cartridge, detonator and safety fuze (the total charge 36 lbs). The torpedo was then deliberately placed through the entanglement about halfway from the ground as described in the *R.E. Journal* of January, 1913; the charge was successfully detonated and made a clearance of an average width of 20 ft. (*Photo* 1).

2. *Guncotton Rope.*—This rope consisted of the 1-oz. conical G.C. primers threaded on a tracing line without their cardboard cases. The rope was 26 ft. long with 250 primers. An extra primer was attached to the other primers at the near end with a piece of tape through the hole to allow of the insertion of detonator when rope was thrown. One man doubled up with the rope already coiled at about 100 yards from the entanglement, and threw it

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over it. The detonator No. 8D and fuze was then inserted and fired. The charge successfully detonated, but beyond a clearing of about 6 ft. in the shape of a diamond at the last bay, very little other damage was done.

3. *Grapnel* (*Thrown*).—The grapnel was laid in position 100 yards from entanglement, and one N.C. officer and three men doubled up behind the covering party (which occupied a crater of a mine previously fired) and threw the grapnel over the entanglement. It was then hauled on by 30 men and part of entanglement pulled away; it was thrown the second time and again hauled on, and the result of both pulls was a clearing of 12 ft. wide for a depth of 18 ft., a depth of 6 ft. on the enemy's side being only slightly damaged.

4. *Grapnel* (*Crawling*).—The grapnel was attached to a short length of 2-in. steel wire rope about 35 ft. long, with a shackle "A" at the other end. One man (No. 1) crawled under the entanglement taking with him the shackle end of the rope, and when through a line (1½-in. lashing) was thrown to him which was attached to an eye splice (B) at the end of a 2-in. steel wire rope. No. 1 next hauled the eye splice to himself and connected it with the shackle "A." The grapnel was then hooked on to the wire rope. 30 men hauled on the wire rope. A clearing 12 ft. wide on the far side to 18 ft. wide on the near side was made in the entanglement.

Passage of High Wire Entanglement by Various Devices.—1. *Planks* (*Fig.* 1).—Sixteen of these double planks were used, each carried by one man. Time taken to place the planks 140 seconds. The infantry crossing party, 17 men, took 60 seconds to cross. Weight 32 lbs.

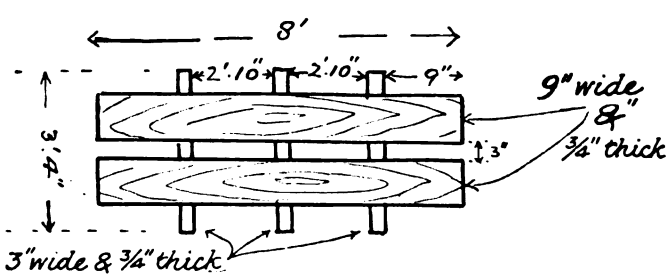

FIG. 1.

2. *Ladders* (*Fig.* 2 and *Photo* 2).—These ladders were 12 ft. long and 18 in. wide with 9 rungs. Weight 32 lbs. Ten were used, each carried by one man. Time taken to place ten ladders 145 seconds. The infantry crossing party, 17 men, crossed over in 65 seconds.

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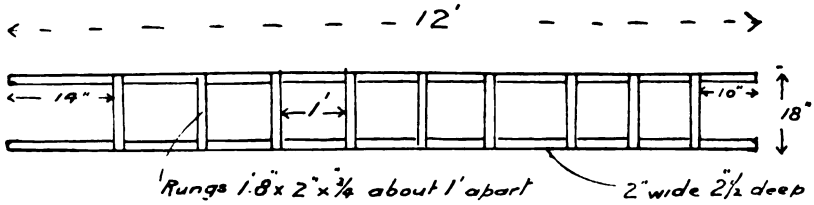

FIG. 2.

3. *Canvas Mats* (*Fig.* 3).—These mats were made of Willesden canvas stuffed with straw, 8 ft. long by 3 ft. 6 ins. wide, and weighed 40 lbs. Sixteen were used and each carried by one man. Time taken to place the mats 95 seconds. The infantry crossing party, 17 men, crossed over in 45 seconds. These mats are too bulky for one man if the distance they are to be carried exceeds 100 yards. Two sides and one end are stitched with spun yarn, turned inside out, filled with straw, and the remaining end is sewn.

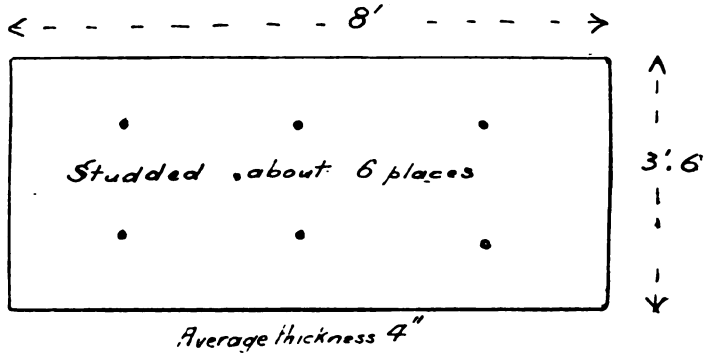

FIG. 3.

4. *Wire Mats* (*Fig.* 4 and *Photos* 3 and 4).—Made of wire netting 4-in. by 5-in. mesh, 3 ft. wide, cut off into lengths of 8 ft. with about 3 in. of straw between. Weight 20 lbs. Sixteen were used, each carried by one man. Time taken to lay the mats 90 seconds. The infantry crossing party, 17, took 65 seconds to cross. The sides and ends of the mats were bound with wire, studded about six places.

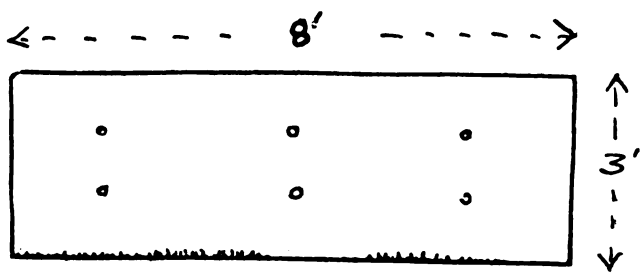

FIG. 4.

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5. *Wire Cutters.*—Eight men in two ranks, each with cutters and gloves, took 95 seconds to cut the wires to make a passage about 6 ft. wide.

DESTRUCTION OF ABATIS BY A DYNAMITE TORPEDO SAME AS USED FOR HIGH WIRE ENTANGLEMENT (*Photos* 5 and 6).

The abatis was 10 yards long, 8 yards deep, and consisted of four rows with barbed wire interlaced. The torpedo was placed in the centre of the abatis, and the result of the demolition was to make a clearing of about 12 ft. wide.

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ROYAL ENGINEER INSPECTIONS.

By COLONEL W. BAKER BROWN.

PRIOR to the issue of the 1910 edition of the *Regulations for Engineer Services*, the principal inspection of buildings and works made by Engineer officers was that known as the "Quarterly Inspection." At this inspection every part of every barrack or building was visited by an officer, the list of fixtures was checked, the state of repair examined, drains and water supply inspected, and fire engines worked. After the inspection requisitions were prepared in the R.E. Office and sent for signature by the O.C.'s of units who frequently contested their accuracy, especially when damages were assessed against the unit.

There were many objections to this system, while the interval between inspections was both too long and too short. It was too long for the execution of minor repairs and replacement of damages, while it was too short for a real inspection by the Division Officer of the condition of the barracks, which certainly did not want to be checked in detail four times a year.

The result of the first was that all officers commanding, unable to wait for the next quarterly, used to send in intermediate requisitions for any repair required as soon as it was brought to their notice, using for this purpose the "urgent" form of requisition A.F. K 1306. Correspondence then arose as to whether the work was really urgent or not, frequently resulting in a shortness of temper on both sides and an abuse of the R.E. and all their ways.

Again, from the contractor's point of view, the interval was too long. A contractor has to engage a regular staff and employ them throughout the year without a break. He must therefore arrange to distribute all work ordered over the year, and is compelled in his own interests, on receipt of a quarterly requisition, to spread the work at least over a quarter. Thus as much as six months may elapse from the time a service is noted as required by a unit till its execution. Further as no quarterly can be completed within its own quarter, and the final bill cannot be prepared until all the work on a requisition is finished, the completion and billing of work is delayed, the contractor is kept waiting for his money and various irregularities are likely to creep in, especially if any change of *personnel*, such as a foreman of works, takes place during the six months. Also it was nearly always necessary to carry over the bills for the last quarter

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to the next financial year, which again gave an opening for irregularity.

In the new edition of *Engineer Services*, para. 438, advantage has been taken of the monthly inspection of buildings ordered by *King's Regulations*, 992, to allow the O.C. of each unit to send in monthly an ordinary requisition for repairs on A.F. K 1308. This procedure is obviously in accord with the principle which underlies the whole of the new Engineer services that the relation between the R.E. and the troops are those between a landlord (or more properly the landlord's agent) and a tenant. A noteworthy example of this is the procedure in para. 485, under which the O.C. unit makes his own arrangements for the repair of damages (except in certain cases) either by his regimental workmen, or direct with the T.C. This saves much work in the R.E. Office and gives the O.C. much more interest in the condition of his barracks.

Now if this monthly procedure is properly carried out, the work of the quarterly inspection is much simplified, as there will be no longer a long list of repairs to be noted by the R.E.; the D.O. can then check generally the work actually done since his last inspection and can give his attention to the more important questions, such as the larger repairs of floors and roofs and the maintenance of drainage and water supply.

King's Regulations, 992, retains a proviso, that in the months in which the quarterly inspection is made by the R.E. the O.C. unit need not make his monthly inspection. But, as he is still responsible for sending in his monthly requisition on A.F. K 1308 (*Engineer Services*, Sec. 438), if arrangements can be made with him to do so without waiting for the quarterly inspection, it will tend to the repair work proceeding regularly throughout the year. If this is done, the services noted at the quarterly will be reduced to those special to the R.E. These include, usually, some minor repairs larger than are dealt with by the O.C. unit, occasionally a minor new service of a "trivial" nature under *Engineer Services*, para. 637, and the services enumerated in *Engineer Services*, 132.

It should, I think, be laid down as a standing rule that none of these services should be carried out on requisition. A requisition is strictly a request from someone outside the R.E. for the execution of R.E. work, and is meaningless if signed by the D.O. The use of the requisition form dates from the time when the only funds at the disposal of the D.O. were those of the incidental item. It was thus much easier for him to include items on a requisition than to ask the C.R.E. for a special allotment of funds. Also a little trouble and clerical work is saved by including several repair items on one requisition, but on the other hand there is a relaxation of financial control and as I have already pointed out considerable delay in completing the billing. The use of the requisition system lends

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itself to abuse, in the addition to requisitions of extra services which are often ill-digested and extravagant.

A very frequent and flagrant abuse is the inclusion in a requisition of a partial repair, such as a bit of a concrete floor or the pointing of a wall, the total service being spread over several quarterlies. In this way a service much exceeding the limits laid down in Table H, *Engineer Services*, can be executed by a D.O. without exceeding the letter of the Regulations. To stop this, I directed that no trivial service exceeding £5, and no maintenance service exceeding £10 should be dealt with on requisition. The services enumerated in para. 132 should not be dealt with on requisition, but should be treated as periodical services and brought forward for consideration at fixed times of each year.

If the above procedure is enforced, the question arises whether four formal inspections a year by the D.O. are necessary. Of course no D.O. will have limited his inspections and visits to works to four occasions only, but he will have had frequent occasions to visit every part of his division in connection with the execution of the larger services, measurements, etc. But such visits are made without reference to units, and therefore differ from the formal inspections which are made in company with an officer of the unit. Now it is probable that the inspection in the last quarter of the year is of little use. There should be very little money left at this period and if there is, the contractor can only get the work done within the financial year by extra pressure and often at extra expense. On the other hand the R.E. Staff is always very busy at this period. Similarly in the second quarter of the year at home stations the troops are especially busy with training.

I suggest that, provided the system of monthly inspections by units and monthly requisitions for repairs is carried out throughout the year, it would be sufficient to have two formal D.O.'s inspections each year, one in the first quarter as soon as the maintenance allotments have been made for the year, and one in the third quarter after the training season and when the amount of probable savings on authorized services should be known approximately.

This will free the R.E. Staff in the second quarter for the work connected with the Estimates for the following year, while in the last quarter I propose, as explained below, to carry out the annual inspection by C.E. or C.R.E.

Reference must be made to the inspection of R.E. fixtures which used to be done at quarterly inspections. These fixtures are detailed on inventory boards and really form a large and valuable store account for which the R.E. are responsible. As the stores are struck off ledger charge when fixed and there is no subsequent audit, it is an obvious duty of the Division Officer to see that these fixtures exist and that the records are up to date. But a good deal of clerical

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work is involved in keeping these records corrected to date, and when there is a pressure of work (and pressure is almost the normal condition in all R.E. Offices) records are always one of the first things to get in arrears. It is thus very essential to have a formal check, and this check should be primarily carried out at marching in and out inspections on change of unit, at which time the incoming unit sign the inventory boards and assume responsibility for the fixtures. In many corps, however, relief takes place by details, while individuals are always constantly changing. It would seem desirable therefore to arrange for an annual inspection of all R.E. fixtures, except where a change of units has occurred within the previous six months. This inspection might be spread over any convenient part of the year, preferably in the leave season.

It should be made jointly by an R.E. officer and an officer of the unit, and both officers should initial and date the inventory boards in token that they have found everything correct. It would be a convenience if columns for this purpose were provided on the forms.

There remains to consider the formal inspection by the C.E. or C.R.E. under para. 996, *King's Regulations*. This para. lays down that "the C.E. or his representative will inspect the barracks annually" and *Engineer Services*, para. 126, explains that the officer making the inspection will usually be the C.R.E. and adds that the inspection is to include all W.D. buildings and all fortifications. This inspection of fortifications is very important and might well be referred to in the *King's Regulations*.

Of course the C.R.E. will not limit his inspections to one annual visit, but will have frequently visited all parts of his district, especially in connection with the execution of the larger services for whose designs he is responsible under Table H, *Engineer Services*. Similarly the C.E. will have visited all parts of a command.

The value of the annual inspection, as in the case of the D.O.'s inspections, lies in the fact that the unit must be officially represented by a senior officer. *King's Regulations* lays down that an officer not under the rank of captain should attend the inspection, but whenever possible the O.C. unit himself, or at least his second in command, should be persuaded to attend. It is very desirable also that the sanitary officer of the command, or at least the medical officer in charge of the barracks, should also attend the inspection.

In accordance with *King's Regulations* the inspecting officer has to make a report of his inspection which is forwarded through the C.E. to the G.O.C.-in-C. But this inspection can also be used for a discussion on the spot, with the officer of the unit and the sanitary officer, of any new services in connection with the barracks which have been brought to notice under para. 266, *Engineer Services*, and have been placed on the Estimate Book, or any large repairs which have been noted by D.O. under para. 270.

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Such discussion is most valuable, not only in getting the views of O.C. unit at first hand, but in giving an opportunity for explaining the system of Engineer Estimates and the details of financial control which have to be complied with before a service can be commenced. The O.C. unit then realizes that an effort is being made to attend to the health and comfort of himself and his men, while the practical suggestions he is able to make are often of great use. Of course in a new barracks there will be little work to do in the way of improvements, though even then the views of the troops on the modern arrangements and fittings, should prove a useful guide in future designs.

As regards the time of year for this inspection, I suggest the month of January. By this time the estimates for the following financial year will have passed the War Office and some notification will have been received at the station as to probable allotments. In any case the C.R.E. will know which major services have been recommended by the station and will know the probable average allotment for minor services. The D.O. will have made his last inspection in October or November, and will have had time to digest his Estimate Book and make up his mind as to which repairs or renewals are most urgent. The C.R.E. is therefore in a position to select the minor services he proposes to execute in the following financial year to the extent (say) of three-quarters of his probable allotments, and will have time before the end of the financial year to complete the designs and estimates for the selected services and, if abroad, to send home demands for the stores required.

Summary of Recommendations.

It will be convenient to conclude by a summary of the above recommendations and suggestions.

These are that the regular inspections made in connection with Engineer services in buildings and fortifications should be :—

1. Monthly inspections by the unit or corps in occupation followed by requisitions on R.E. for repairs which cannot be dealt with as damages by the unit concerned.

2. Half-yearly inspections by Division Officers in first and third quarters accompanied by an officer of the unit, followed by orders by D.O. for any large repairs found necessary.

Note.—If any small repairs are noted which have been overlooked, they can be included by the unit in the next monthly inspection requisition.

3. Annual inspection of R.E. fixtures during the leave season unless a marching-in inspection has been held in the previous six months.

4. Annual inspection by C.R.E. (for C.E.) in January followed by preparation of the minor services for following financial year.

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To above must be added

5. Technical inspections of boilers and machinery annually, under *Engineer Services*, 127.

6. Inspection of lightning conductors, biennially, *Engineer Services*, 128.

7. Perambulation of boundaries, annually, *Engineer Services*, 149. Also where electric light is installed in barracks, a periodical test should be made of the condition of all mains and circuits. All these should be carried out at a time when they interfere least with military training.

It is perhaps hardly necessary to add that the object of the above suggestions is not to add to the labours of R.E. officers, but to encourage a systematic study of procedure and so to simplify and reduce work and avoid unnecessary repetition.

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THE WORK OF SIGNAL UNITS IN WAR.

A Lecture delivered to No. 3 Senior Officers' Class, S.M.E., by COLONEL R. S. CURTIS, C.M.G., D.S.O.

Scope of the Lecture.—I have been asked to give a lecture on the work of the signal units in war; but must preface my remarks by saying that I shall confine myself to the work which would be carried out by the signal units of the Expeditionary Force serving abroad, and I will not touch upon the work of signal units when engaged on home defence.

THE NEW ARMY SIGNAL SERVICE.

Until recently—as you all know—the service of inter-communication in our army was practically carried out by the following branches, working more or less separately :—

(*a*) Telegraphy and telephony by the Royal Engineers Telegraph Companies.
(*b*) Visual signalling by regimental and battalion signallers.
(*c*) Orderlies, provided as required.
(*d*) Postal Service.

Army Order of April 1st, 1912, introduced a system by which the first three branches have been combined into what is now called the "Army Signal Service." The Army Postal Service remains a separate branch, and should invariably be used for the transmission of all correspondence not of an urgent nature. Though the Army Signal Service and the Army Postal Service are separately organized, it is essential that they should work in close co-operation, rendering each other such mutual assistance as may be possible.

The Units of the Army Signal Service.—The Army Signal Service units, now laid down for the expeditionary force (which consists of a cavalry division, six divisions, two mounted brigades, and army troops and lines of communications) is :—

1 signal squadron for the cavalry division.
4 signal troops—one for each cavalry brigade.
2 signal troops—one for each mounted brigade.
6 signal companies—one for each division.
2 signal companies, air line
2 signal companies, cable } for army troops.
1 signal company, wireless
1 signal company for line of communication.

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Functions of the Various Signal Units.—I will now take each of these various units and describe what are their normal duties.

The signal squadron carries out the inter-communication between the cavalry divisional headquarters and the cavalry brigades; and also with reconnoitring detachments, when required. In addition, it can keep touch with general headquarters by wireless telegraphy. For these purposes the signal squadron is organized in four troops, viz.:—

"*A*" *Troop.*—Which has two wireless (wagon) detachments that communicate with general headquarters.

"*B*" *Troop.*—Which has two cable detachments, with 28 miles cable, and eight vibrator offices, that are intended to keep cavalry divisional headquarters in touch with the wireless stations of the squadron, or to connect up the permanent telegraph system. They can also be used for internal communications of the division.

"*C*" *Troop.*—Which has one wireless (wagon) detachment and three wireless (pack) detachments. These are intended for communication between divisional headquarters and brigades or reconnoitring detachments, and

"*D*" *Troop.*—Which has 12 mounted men, 28 cyclists, six motor cyclists with two motor cars. This troop is intended to carry out visual signalling, or despatch riding in conjunction with or in lieu of other means of inter-communication within the division.

Signal Troops.—The signal troop with each cavalry brigade consists of 11 mounted men, six bicyclists, three motor cyclists, and has in addition an equipment of $7\frac{1}{2}$ miles of cable with eight telephones. This unit is intended to carry out the inter-communication within the brigade.

Signal Troops with Mounted Brigades.—The signal troop with mounted brigade is similar to that with the cavalry brigade; but has, in addition, two wireless pack detachments which would communicate with the wireless stations of the cavalry division or of general headquarters, as found necessary.

Signal Company with a Division.—The signal company with a division is organized with a headquarters and four sections, and is intended—primarily—for intercommunication within the division. The headquarters and No. 1 Section—which has three cable detachments with 30 miles of cable and nine vibrator offices, also four mounted men, eight bicyclists, nine motor cyclists—carries out communication between divisional headquarters and the brigades. The other three sections are allotted—one to each infantry brigade for its internal communication. Each section has two telephone detachments carrying in all 8 miles of cable and ten portable telephones; it has also eight bicyclists for visual signalling or despatch riding.

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Signal Companies (Cable).—Two cable companies form part of the army troops, and carry out inter-communication between general headquarters and army, or divisional headquarters. Each cable company has nine detachments in all (four sections of two detachments, and one extra detachment), each with 10 miles of cable and three vibrator offices, with 13 motor cyclists.

Signal Companies (Air-Line).—The two air-line companies also form part of the army troops, and carry out inter-communication between general or army headquarters and the advance base, or as required. Each air-line company has three sections of two detachments each, *i.e.*, six air-line detachments in all, with 10 miles of air-line and two second-class offices—also 24 miles of cable with six vibrator offices.

Signal Company (Wireless).—The wireless signal company also forms part of the army troops, and carries out inter-communication between army headquarters and cavalry divisional headquarters or mounted brigades. It has three wagon stations and 13 motor cyclists.

Signal Company (Line of Communications).—The line of communication company carries out inter-communication on the line of communication, and for this purpose is equipped normally with 100 miles of air-line and 10 offices with nine motor cyclists—it also provides *personnel* for working telegraph offices and maintaining lines on the railway system in use. These *personnel* are under the orders of the Director of Railway Transport.

Necessity of Sometimes Altering Allotment of Signal Units.—You will notice from the above that the signal units are allotted so as to suit the normal organization of the expeditionary force; but it must be understood that such allotment may be altered at any time, and the whole or part of a signal unit may be withdrawn for employment elsewhere. Further, for instance, although the cable company usually would keep up communication between general headquarters and an army headquarters, it would often be preferable to employ air line. Again, although the line of communication ceases at the advanced base, it would usually be advisable for the line of communication to carry out and maintain all inter-communication in rear of general headquarters.

Having described the organization of the Army Signal Service, so far as the units are concerned, I will now explain the system of administration.

Administration of the Army Signal Service.

The whole of the Army Signal Service is administered by the Director of Army Signal, who has representatives at the following headquarters :—

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At the headquarters of the Inspector-General of Communications: A Deputy Director of Army Signals.
At headquarters of an army: An officer i/c army signals.
At headquarters of the cavalry division: The officer commanding the signal squadron.
At headquarters of a division: The officer commanding signal company.
At headquarters of a mounted brigade: The officer commanding signal troop.

The Director of Army Signals is authorized to communicate direct with his representatives on all matters of an administrative and technical detail connected with the Army Signal Service, and his representatives are similarly authorized to communicate with one another on such matters.

The duties of an officer in charge of army signals with headquarters of an army are:—

(i.). To act as the technical adviser of his commander in matters pertaining to Army Signal Service, receiving his instructions as regards its employment through the General Staff.
(ii.). Under the orders and within the limits of command of his commander, to be responsible for the general organization, maintenance, and efficiency of the service of inter-communication, other than the postal services.

The commanders of signal squadrons, signal troops, companies and sections are in their respective degrees charged with analogous powers and responsibilities.

Description of the Means Taken to Provide Inter-communication in the Field.—Having explained the organization and system of administration I will now endeavour to describe the means employed by signal units to provide and maintain communication.

To begin with—we will suppose the Expeditionary Force is to be employed in a friendly civilized country overseas, with a view to operating against an enemy in an adjacent territory. Arrangements would probably be made between our government and that of the friendly country for the use of a submarine cable and of the telegraphic and telephonic systems. A portion of the line of communication signal company would be sent to take over certain permanent lines and offices, and, if necessary, to supplement them by air lines, etc. On the arrival of the expeditionary force it would be the duty of the signal service to join up the various larger units, either by employing the permanent telegraph system or by temporary connections. As the force moved forward it might be impracticable to continue the use of the permanent systems, in which case field methods would have to be employed.

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Diagram I. shows the communication which would possibly be made on the arrival of the Expeditionary Force, prior to its move forward. You will notice that general headquarters is connected with the advanced base by two permanent lines borrowed from our friends, and that on one are working Wheatstone automatic instruments, which can send 200 to 400 words a minute, and on the other line the work is carried on by sounders at about 30 words a minute. In this case the line of communication company would maintain and work these two lines under the Deputy Director Army Signals.

From general headquarters to the cavalry division a permanent line has been used for a portion of the way and the remainder made up by cable. It is necessary to use vibrators on this connection as sounders will not work through such a long length of cable (over 12 miles) as this is supposed to be. From general headquarters to the 1st Army a permanent line with sounders inserted is in use. An air line has been erected with sounders between general headquarters and 2nd army headquarters.

A cable with vibrator connects to the reserve (6th) division, and the 2nd mounted brigade is kept in touch by despatch riders or visual signalling. Taking the internal communication of the 1st and 2nd armies, the 1st and 2nd divisions are connected to 1st army headquarters by cable and the 1st mounted brigade by despatch riders. The 3rd and 5th divisions are connected to 2nd army headquarters by cable, and the 4th division by despatch rider.

All the above connections from general headquarters to the various units would be carried out by the army troops signal units, *i.e.*, two air-line and two cable companies. In addition, within the divisions would be further connections between divisional headquarters and brigades which would be carried out by the signal squadron, or by the divisional signal company concerned with such means as the local officer in charge of signals considered most desirable.

The Director of Army Signals on receiving from the Commander-in-Chief, through the General Staff, information as to the organization of the army and its probable place of concentration, would no doubt have distributed the two air-line and two cable companies accordingly.

In this case we will suppose that he has allotted to the 1st Army two cable sections, the 2nd Army three cable sections, leaving three cable sections with two extra detachments for work at general headquarters, as well as the two air-line companies. In addition, a small proportion of motor cyclists would be allotted to the 1st and 2nd Army Headquarters.

The Director of Army Signals would have detailed the senior officer of the air-line and cable companies as the officer in charge of Army

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Signals at general headquarters. His duties would be to keep up communication with the two armies, the cavalry division, the reserve (6th) division and the detached mounted brigades. He would also arrange with the Deputy Director of Army Signals (lines of communication) and any details as to the internal organization of offices where the two jurisdictions might meet. The Director of Army Signals would further detail from the air-line, and cable companies officers to act as officers in charge of army signals at the 1st and 2nd army headquarters. These officers would be responsible for keeping up communication between their army headquarters and the divisions, etc., of the army concerned, with the *personnel* and equipment (in this case cable sections and motor cyclists) allotted to them.

We will now suppose the army has advanced and is disposed as shown on Diagram II. These diagrams are of course not intended to represent any actual organization, or movement, but simply to illustrate the working of the signal service.

I will now describe the system as it has now developed, and in doing so I will explain it by taking the zone of each officer in charge of signals in turn.

The Director of Army Signals having received early information from the Commander-in-Chief, through the General Staff, of the intended advance instructs the officer in charge signals general headquarters to push his air line on, and also warns the D.D.A.S. of the probable requirements, including the insertion of a sounder in the line to the advanced base to afford communication with the reserve 6th division. He also arranges with the officer in charge signals cavalry division as to the wireless communication required.

The officer in charge signals general headquarters pushes his air line forward so that when the Commander-in-Chief moves on, a portion of the signal office accompanies him and communication is established on arrival at the new site. He also arranges all technical details with the D.D.A.S. about the insertion of an office for the reserve 6th division for communication from that office to the reserve division. Also for the transfer of Wheatstone automatic apparatus forward. He arranges for communication to be maintained with the 1st and 2nd armies and the detached mounted brigades, and also for the wireless or other communication with the cavalry division. Similarly the officer in charge signals with the 1st and 2nd armies arranges for communication with their component units. The officer in charge signals cavalry division arranges for communication with general headquarters, by wireless, or despatch riders. He also arranges to keep in touch with the cavalry brigades. For example—to the 1st cavalry brigade by wireless, 2nd and 3rd cavalry brigades by despatch rider or visual signalling, 4th cavalry brigade by cable.

The D.D.A.S. in addition to arranging for the insertion of the

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office for the reserve (6th) division has made arrangements to take over early maintenance of air line behind general headquarters, to have ready additional air-line material to forward when required, and also for the organization of a clearing house. I will not go into the working of the smaller units as the principle throughout is the same, namely, that every officer in charge of signals should arrange such means of communication as are available from the *personnel* at his disposal.

Description of the Various Methods and Equipment used for Intercommunication.—I hope the preceding explanations will have given you a clear insight into the general working of the signal service and I now propose to mention some details of the equipment.

Air Line.—Field air line which consists of a bare wire erected on light poles can be erected at the rate of about 5 miles a day by a detachment of 12 non-commissioned officers and men—Rate, half to 2 miles per hour.

Field Cable.—Field cable is an insulated wire laid on the ground, at a rate of 1 to 6 miles per hour (average 3) by a detachment of eight N.C.O.'s and men—Artillery and infantry use a lighter cable.

Wireless Equipment.—Wireless equipment at present consists of (*a*) wagon stations, (*b*), pack stations.

(*a*). The wagon stations consist of a limbered vehicle which carries the apparatus and the mast with antennæ, and a light wagon carrying spare stores, baggage, etc. A wagon station can maintain communication with a similar station up to about 80 miles.

(*b*). A pack station, which is usually carried in a limbered G.S. wagon, can also be quickly transferred to four pack horses which are led by four men on riding horses who form the working detachments. Pack stations can work to each other up to about 20 or 30 miles.

Wagon stations can work to pack or *vice versâ*. The limit of transmission being about 80 miles from " wagon " to " pack," and 20 to 30 miles from " pack " to " wagon." Stations take 15 to 30 minutes to erect.

All these distances vary considerably with the conditions of the country, weather, and time of day or night.

The great problem of wireless telegraphy is to overcome interference or overhearing. It is possible to overcome the former to a certain extent by what is called " tuning." The latter can be overcome by sending messages in cypher—but in any case wireless traffic in the field wants very careful handling at present.

Necessity for Periodic Work when Several Stations are in the Field.—When more than two stations are at work in order to minimize interference from one's own stations—leaving hostile interruptions out of the question—very careful procedure has to be adopted.

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Taking a case as is shown in Diagram III., which is extracted from Diagram II. The two stations at general headquarters, or cavalry division headquarters, must send at the same time. It is at present impracticable where two stations are close together for one to send and the other to receive at the same time. Period working, combined with "tuning" is therefore necessary. Thus—G.H.Q. works from five to ten minutes in each quarters of an hour to C.D.H.Q. and 2nd mounted brigade on the 3,000 and 2,300-ft. waves respectively. Cavalry division to 1st cavalry brigade, and general headquarters on the 1,700 and 3,000-ft. waves respectively, during the 0—5 period, and so forth.

In case of an important reconnaissance accompanied by a wireless detachment, it may be necessary to close down all sending at other stations, and instruct them all to listen to signals from the reconnoitring party.

Aircraft Wireless Apparatus.—Aircraft have recently been fitted with wireless apparatus, and from the experience with the airships good results may be expected. There is much difficulty in receiving on aircraft owing to the noise of the propellers drowning the signals in the telephone receivers.

Visual Signalling.—You are all well acquainted with the various methods of visual signalling, and its advantages in some countries—and its disadvantages in others. Heliographs are limited only by range of vision. Flags may be read from 3 to 7 miles. Limelight lamp 10 to 15 miles. Begbie lamp 5 to 8 miles. Dietz discs are now under trial, as are also various forms of oxy-acetylene, and electric lamps.

Despatch Riding.—The other method of inter-communication is by despatch riding; for which horse, bicycles, motor cycles and motor cars are used. Their pace depends upon the nature and state of the country, the amount of traffic on the roads, etc. During the recent manœuvres motor cyclists did very valuable service. All despatch riders must have a detailed knowledge of organization of the army, and also be quick map readers.

Description of the Transmission of a Message.—I will now describe what happens to a message, and will take, as an instance, one sent in from the 1st cavalry brigade in Diagram II. containing information which requires to be forwarded to general headquarters, and thence to England.

The General Staff Officer concerned having written the message in triplicate, as it is of an important nature, hands two copies to the officer in charge signals, with the brigade, the latter being advised at the same time that it would be better to send it by more than one route. The officer in charge signals hands copies to the clerk in charge of the signal office who, having coded and registered the message,

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sends one copy for despatch by wireless telegraph. The other copy he hands to a despatch rider to take to the signal officer at the cavalry division headquarters, and notes name of rider and time of starting. We will suppose that the wireless message arrives at the wireless station cavalry division headquarters. It is checked and passed to signal office from where it is sent by orderly to the cavalry division headquarters. The despatch rider arrives later with his copy at the signal office, and it being noted that another copy of the message has already been received, it is delivered and the despatch rider with his receipt is sent back to the 1st cavalry brigade signal office.

Meanwhile, the cavalry division headquarters has prepared another message in triplicate, containing the information received, and send it to the signal office for transmission. The same procedure follows as before, and the message is delivered at general headquarters.

In towns, it is usually impossible to collect near the general headquarters the various means of transmission. For instance—the only site suitable for a wireless station may be half a mile from the buildings selected for headquarters. Similarly the telegraph offices may be scattered according to the locality, and visual signalling may only be possible from a hill outside the town.

Signal Office.—A signal office is therefore established near the headquarters, where all messages are dealt with on arrival, or just before delivery; and near it are collected the despatch riders, also the messengers for conveying to and fro the messages between the various centres of transmission and the orderlies for delivery of messages.

We will suppose the message from the cavalry division headquarters arrives by wireless, the receiving stations being half a mile from general headquarters. After checking, it is sent by messenger to the signal office, where, after registration, it is passed by orderly to the headquarter staff.

The general headquarters now prepare a message for transmission to the War Office in England. It is sent by orderly to the signal office, where it is registered and then sent by messenger to the telegraph office from whence it is despatched to the advanced base, and so on, through the submarine cable, to England.

The signal office at general headquarters, with its component parts, viz. :—Telegraph, wireless, visual signalling, despatch riders, clerks, etc., requires careful organization, and it must work in reliefs, all the staff being highly trained, and it must be divisible.

When the general headquarters moves to another place the officer in charge general headquarters signals has to arrange to send a portion of his staff on, so that communication is at once established on arrival at headquarters. The same principle applies in lesser degree to signal offices at army, division, and other headquarters.

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Now, gentlemen, I have endeavoured to explain to you the working of the signal service and how it is designed to assist the army in the vital requirements of intercommunication. Officers of the signal service have a very arduous time, and require quick decision and a rapid grasp of situations; but they can be enormously helped by those using the signal service, if their difficulties are comprehended and, as far as possible, eased. The first desideratum is that the various officers in charge of signals should receive early information of any projected move, so that they may organize the means at their disposal. Other desiderata are, to adhere to the instructions laid down for writing messages; to send nothing by signal service which could equally well be transmitted by the postal service; and finally to remember that the signal service is human, and when delays occur to postpone criticism until the cause is discovered.

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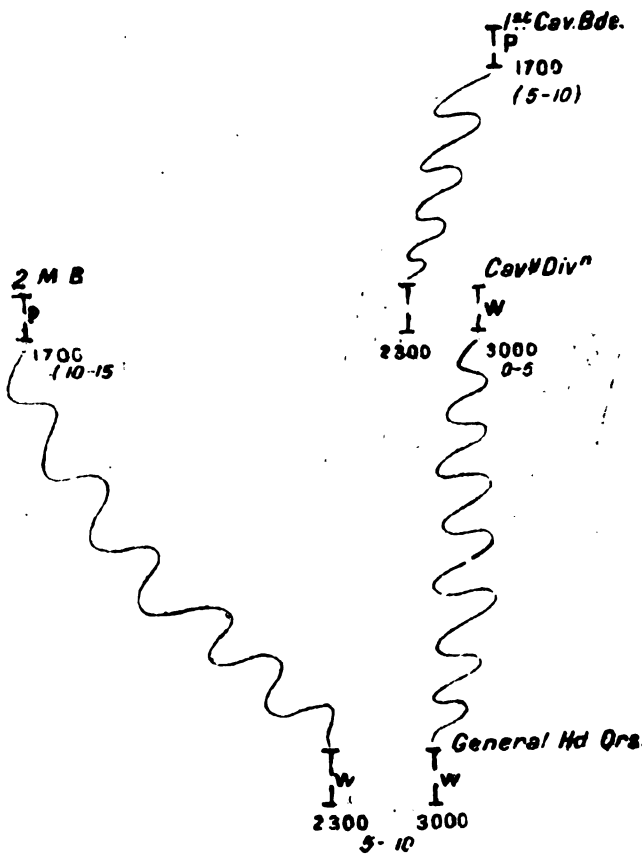
Diagram III



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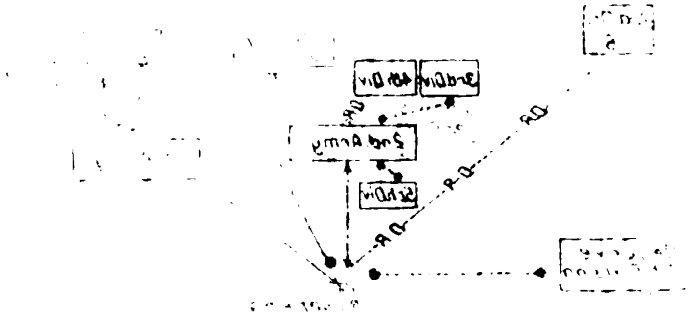

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FORTRESS DEFENCE.

Conventions opposed to the Offensive Spirit.

By Major J. W. S. Sewell, R.E.

In the August number of the *R.E. Journal*, Major Matheson takes up my criticisms on the apparent lack of the offensive spirit in the writings of Continental Engineers on the subject of permanent fortification.

He appears to be a little hurt that I should have taken his paper as a basis for my remarks—may I take this opportunity of pointing out that this was done in no spirit of contradiction to himself. His paper is, for the most part, an able summary of the ideas prevalent in Europe, as evidenced by the numerous works and articles on this subject which have been published in recent years. From such a summary it is easier to deduce the general trend of thought, which, as I attempted to indicate, does not yet appear to have progressed in consonance with the offensive spirit dominating the manuals and text books devoted to action in the field.

It will perhaps reveal more clearly those points on which we differ, if I take Major Matheson's remarks seriatim.

It would appear that he agrees with my main contention that the offensive spirit is only nascent at present in fortress design; but he waives this aside with the remark that it is not a matter for surprise. Perhaps not; but that does not or should not prevent it from being a subject for criticism.

Then we come to the vexed question of the intervals between the main groups of works (*feste*). I think it will be accepted as an axiom, that these should be neither greater nor less than is necessary to prevent an attack, which would involve the fall of the fortress, being launched between two such *feste* without the necessity of first capturing at least one of the *feste*.

Engineers will differ as to what such interval should be; and the nature of the terrain must ever be the decisive factor. I have perhaps been too mathematical in attempting to indicate a probable interval; but an examination of the plans of fortresses, from the days of Vauban up to recent times, would appear to indicate that

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the engineers of the past have in general fixed on twelve as an approximate number for the main key points of a fortress situated on an open terrain, that is to say on a terrain which is not very greatly accidented. Major Matheson says that the fewer the key points the greater will be the mobile force and, therefore, the greater will be the garrison. I put it somewhat differently, viz.:—for a given garrison, the fewer the key points, the greater will be the mobile, that is, the offensive force. It appears to me that Major Matheson contends that we should construct works in the intervals to repulse the enemy's attack. My contention is that our fundamental idea should be to get him into such a position that we can *destroy* the attacking force. In this connection I have received letters from an officer whose opinion I hold in great respect, in which he joins issue with me on the ground that I take too optimistic a view of the quality of troops likely to form a fortress garrison. He argues that all but the fortresses covering the preliminary strategic concentration will perforce be garrisoned by what he aptly describes as "n-th line" troops, who from lack of training will be totally unable to take offensive action. Well, in such cases, by all means let us cover our fortress with 2nd line works, keeps, retrenchments, obstacles, *et hoc genus omne;* but do not let us assume this to be the ideal of fortress design. Personally, I think he is too pessimistic; before such fortresses come into action, the Commandant will have had some chance of training his troops; and, moreover, it seems probable that the Government will have sued for peace on the principle of cutting its losses.

As to works in the intervals Major Matheson says "Offensive movements . . . should be aided by the provision of a few trenches and obstacles to cover unseen ground, and to force the enemy into areas where he can be attacked with advantage." I am in entire concurrence. My own words were ". . . in such intervals . . . there will be ground which is invisible to the flanking artillery . . . It will probably be necessary to cover such ground or points with small closed infantry works. These should, however, only be of a nature to check an attack until the reserve can come up and drive back the assailants." On the whole, I prefer Major Matheson's expression.

He then objects, naturally, to my criticism of his choice of an example (*Plate* XVIII., *R.E. Papers* IV., 3). Most readers of the *R.E. Journal* will recognize the site. We may waive any contention as to this site being inexorably determined for a group of works; but I cannot admit that it is typical, it is a difficult site at best, for reasons given in my previous article. I agree that it would be a good site to choose were one seeking to ascertain how to adapt

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agreed principles to a difficult site; but I still think that an easier site would afford better opportunity for a reader to understand the principles which Major Matheson seeks to inculcate. On the site selected the necessary adaptation of details to the ground obscures the governing principles. It certainly has already led me to misunderstand the function of Major Matheson's "fort-nucleus," a subject to which I will refer later.

Major Matheson says "It is somewhat difficult to see very much difference between the organization of Major Sewell's group and that which I put forward." As regards the group, we are, I fear, distinctly at variance, notably as regards the "fort-nucleus," but from the remainder of the paragraph I gather that he refers to the infantry works which constitute the key points of my group. I think we have both recapitulated the current ideas of the school in which we were both trained and are thus naturally in agreement. But if this implies a charge of plagiarism, I would observe that I read Major Matheson's paper to advocate a "cut-and-cover" work, whilst I ventured to suggest that a "mined" or "tunnelled" work, on a similar plan, might, under certain conditions of ground, time, and engineering economics, provide a work more bombproof and less visible. I regret that I did therein unconsciously plagiarize the idea of Capt. Holt Wilson, who suggested this system for a fieldwork in the *R.E. Journal*, August, 1911.

As regards the geometric trace, Major Matheson entirely misses my point. It is not a question of lines being "straight or wavy," neither of which adjectives adequately conveys in fact an impression of Nature's contours (imagine telling a woman that her figure was either straight or wavy). It is not even chiefly a matter of invisibility to the enemy's artillery. It *is* a matter of getting the best position for each rifle. In fact the fire trench must be designed *in situ*, and afterwards recorded on a paper plan, on which may be added all accessory works. The geometric trace is the outcome of the attempt to draw a paper plan first, and then make the ground fit it.

I admit the great skill which has rendered invisible the two small redoubts to which Major Matheson alludes. These redoubts, however, contain practically none of the accessory constructions required for our infantry work, and—which makes a great difference—have no escarp. Their neighbours can hardly be called invisible by their most devoted admirers. In general the forts of the last half-century can by no means be classed as invisible. The southern front of Antwerp presents to the view, over a wide area, forts which are the dominant features of the landscape. Many continental forts, it is true, are at present invisible, but it is impossible to say

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that they will remain so, when their defenders are themselves enabled to see their enemy, by the clearing of the concealing groves of trees.

On the matter of retrenchments, Major Matheson adopts a double standpoint. On the one hand he regards a retrenchment as an advanced shelter for the reserve. If this is what he means by "a retrenchment" I concur at once, such cover close up for the reserve will most certainly be required towards the end. But the usual interpretation of that word is a trench, or trenches, into which the defenders of the front line may retire, and Major Matheson takes a second standpoint, when he argues that such works may delay for a day or two the fall of the fortress. That, I fear, must remain a matter of opinion. There are those of us who hold that whilst retrenchments may be held for a day or two, their existence will almost certainly cause the front line to be abandoned two or three days earlier than would be the case were the retrenchments non-existent.

It appears that we are in agreement that a "group should not be a closed work," though I am not prepared to be so dogmatic on this point. With the exception of the original advocate of groups of works, viz. :—"Un pionnier" (*R.E. Papers* IV., 3, *Plate* XIV.), all continental authors appear to design closed-in groups (*cp. R.E. Papers* IV., 3, *Plate* XVI.).

So far it would appear that the differences between Major Matheson and myself lie in forms of expression, or in the less important details, but when we come to the arrangement of the group, I fear that I cannot understand his ideas. To some extent we appear to be speaking in different languages, and require a mutual interpreter. In the first place he speaks of *the* key point of a group. Now, according to my understanding of the word "key point," a group has several key points, viz., the various infantry redoubts of the front line (*e.g.* all the works lettered "C" in *Plate* XIV. of *R.E. Paper* IV., 3). In every "position" there is usually one work or locality, whose fall, more certainly than that of any other work, involves the loss of the whole position, such a work or locality is usually alluded to as "the key" of the position. Is this what Major Matheson means by *the* key point? Or does the use of the definite article imply that his conception of a group only includes *one* infantry work? In that case what are the five groups of trenches shown in advance of his "fort-nucleus" in his *Plate* XVIII.? Are they outpost trenches, advanced posts, or the main line of defence?

Major Matheson now makes it clear that his "fort-nucleus" is not a keep, and that *Plate* XVIII. is only diagrammatic, but I am no nearer to understanding its true function. At first I imagined the

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fort-nucleus to be intended to enact the *rôle* of the *batterie traditore;* in containing flanking guns it does do so, but as sited in *Plate* XVIII. it does not fire into or between the fire trenches. Moreover the *batterie traditore* is essentially a battery with a small infantry garrison as escort to the guns (a waste of infantry apparently). But it would appear that Major Matheson regards it as also his main infantry work. Now unless *Plate* XVIII. is very misleading, the fort-nucleus cannot assist to repel a frontal attack on the fire trenches in advance. Then what is the *rôle* of its garrison whilst their comrades in the trenches are endeavouring to repel an attack? What, on the other hand, becomes of the garrison of the trenches, after the enemy have captured the trenches, and at last come under fire from the fort-nucleus? A still further and closer perusal of pp. 39 and 40 of Major Matheson's original paper inclines me to regard it as excusable that I should consider that his proposal was to have two lines of defence: *cp.* " . . . is it not better to withdraw the forts from the front line . . . Still the foreground must be covered with fire. This can be done from trenches in the front line . . ." I have no desire to quibble over terminology. Let us agree that the fort-nucleus in such a case does not constitute a "second line." Anyway the proposal appears to be to have a front line of fire trenches with their accessories, and a line of fort-nuclei 300 to 600 yards behind it. If the front-line trenches and the fort-nuclei be on the same plateau or slope this would merely amount to a double tier of fire. But why, if the fire-trench groups are to be held, should they not be provided with that "most efficient obstacle," a ditch? On the other hand, if the forts be in such a position as to fire over the same ground as the fire trenches, the object of their withdrawal, viz. to escape artillery fire, would be lost. If, as shown in *Plate* XVIII., they are withdrawn to the reverse slope, whilst the fire-trench groups be left on the forward slope, this is most assuredly asking for defeat in detail.

Of course there must be something in Major Matheson's proposal which has escaped me, but it would appear to require further elucidation.

To me it would appear that the central retired point which Major Matheson regards as a *tactical* pivot, should form the *administrative* centre and command post. From it radiate the communications along which pass orders, reinforcements, ammunition, supplies, and stores.

Finally, I must confess that the officer to whose criticisms I have alluded above, quite rightly hauls me over the coals for not giving recognition to the necessity for providing an inner work, akin in siting and construction to a keep, but not provided with any intention of holding it as a second line. He observes with truth that to

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build up the mobile offensive force to a maximum, it will be necessary to deplete the garrisons of works on the unattacked fronts, until these may be reduced to practically mere picquets. Such is indeed the essential principle of the offensive-defensive. For such "picquets," works on a scale proportionate to their strength must be provided of such a nature, and in such a position, that they dominate the group, or sufficiently dominate it to enable the picquet to resist an attempt to capture the group by a night attack or other sudden assault.

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NOTES ON WIND PRESSURES.

By CAPT. J. E. E. CRASTER, R.E.

THE following notes were taken by the writer during a typhoon at Hong Kong on the 17th August, 1913.

The wind attained a velocity of 105 miles an hour at the Observatory, and on the Peak, where the writer's house is situated, the velocity reached 120 miles an hour; but as the house is sheltered to some extent by high ground at the back, it is probable that the actual maximum velocity during the observations was not more than 100 miles an hour. The wind came in gusts, separated by comparatively calm intervals, during which the velocity dropped to 20 miles per hour, or less. Before each gust, the aneroid in the house fell rapidly, often dropping $\frac{1}{10}$ of an inch in two or three seconds, and the lowest point was generally reached just before it struck the house. During the gust the aneroid rose again, till at the end of it it was a little above its normal level. The house, though shut up, was by no means air-tight, and it is probable that the aneroid gave a fair indication of the variations of pressure that occurred in the open air.

From the behaviour of the aneroid it seems clear that each gust was caused by air rushing in to fill a partial and local vacuum—caused, perhaps, by a huge bubble of warm air rising through a comparatively cold atmosphere. As soon as this partial vacuum had been filled, the gust ceased. In any house that is comparatively air-tight, the sudden formation of a partial vacuum in the surrounding air must produce a very appreciable outward pressure on the walls, roof, windows, and doors. This is a static pressure (which is entirely independent of the dynamic pressures and suctions caused by wind).

The amount of the static pressure caused by a fall of $\frac{1}{10}$ of an inch on the aneroid would be about 7 lbs. per square foot. This alone would be enough to lift any light roofing material, and to break any large sheets of thin glass. This was well illustrated during the typhoon in question. A large pane of glass had become loose, owing to the putty having fallen away, and the wind whistled out through the surrounding space. The pane was secured and the space all round it filled in with rags. When this was done the room was comparatively air-tight, and, as a consequence, directly the aneroid began one of its periodic falls the whole pane was sucked bodily out

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of the window. After this pane had gone, the strain on the other windows visibly decreased, and no more damage was done. Had the broken window been boarded up as was originally intended, there is no doubt that other windows would have been broken.

In the *R.E. Journal* for December, 1912, Lieut. Satterthwaite quoted a formula for ascertaining the pressure and suction caused by wind on roofs of various angles, the figures given being based on experiments made by Dr. T. E. Stanton, at the National Physical Laboratory at Teddington. On a roof supported by stanchions the leeward pressure, or suction, was negligible, whereas on the roof of an ordinary building, the leeward pressures were large—larger in fact than the windward pressures. This implies that the whole of the leeward pressure on the roof of a closed house is due to the air enclosed in it. For a roof with a slope of 60 degrees, and a wind blowing at the rate of 100 miles an hour, the leeward pressure is given as 32 lbs. per square foot. This is surely too great, for it implies a difference of 0·45 in. in the height of the barometer inside and outside the house, an almost inconceivable state of affairs. If such large pressures do occur, they can only be exerted over a very small area, and it seems quite unnecessary to design roof trusses to resist such pressures over the whole leeward expanse of the roof.

Probably the best way to ensure the safety of buildings against heavy winds, would be to provide ventilators over each door and window, and in the centre of each side of the roof; so that no great difference of pressure could be set up between the external and internal air at any point in the building. Such ventilators should be provided with louvres on the outside, and small-meshed wire gauze inside to keep out rain and mosquitos. In buildings of two or more storeys, ventilators might also be provided to connect the rooms on various floors; otherwise wooden floors lift and fall, in rather an alarming way, and the wind blowing up through joints in the boards fills the rooms with dust.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

(*Continued*).

By MAJOR H. BIDDULPH, R.E.

AFGHANISTAN, 1839–42.

Medal for Ghuznee, 1839.

1·5-in. diameter, silver.

Obverse.—The gateway of Ghuznee, "GHUZNEE."

Reverse.—A mural crown within a laurel wreath, and the date, "23^{D} July 1839"

Ribbon.—Yellow and green, or crimson and green in equal halves, 1¼ in. wide.

Mounting.—A straight silver bar, pivoted.

THE FIRST AFGHAN WAR, 1839–42.

Practically none of the medal rolls for this campaign are extant, either in England or in India, but it is possible by means of collateral official documents to verify nearly all the medals issued to the Queen's troops, and a fair proportion of those issued to Europeans in the Company's service.

The exact number of medals struck for the capture of Ghuznee, 23rd July, 1839, is not known, but the total number of men entitled to it, including the Bengal, Bombay and Shah Shujah's troops was about 11,700. They were issued at first unengraved, but in 1844 the Court of Directors gave instructions that arrangements should be made in future for engraving all medals before issue; and as will be seen later this was done with practically all the medals granted for the 1842 campaign, with the exception of the first Jellalabad medals.

From various records it is evident that very great delay occurred in issuing the Ghuznee 1839 medals to the troops in the Company's service, if not to the Queen's troops, and it is probable that a number were issued officially engraved. The medals were not struck till toward the end of 1842.

No papers are extant showing the particulars of the change of the ribbon from yellow and green to crimson and green; but the reason was (in all probability) to introduce the colours of the ribbon of the Star of the Durani Empire, an order constituted by Shah Shujah after his reinstatement by the British. Sir T. Willshire's medal with

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the original yellow and green ribbon is to be seen in the museum of the Royal United Service Institution, Whitehall; but owing to the delay in issuing the medal it is improbable that this ribbon was extensively worn.

The design of the medal was settled by a committee of officers, and it is pretty certain that the obverse depicting the Cabul gate of the fortress, which was blown in, is taken from a drawing executed by Lieut. H. M. Durand, of the Bengal Engineers, the officer who blew in the gate.

Several European firms were invited to submit dies and proofs to the Calcutta Mint, the cost being defrayed by the Government, and it is not at all unlikely that the Ghuznee medals met with occasionally, which differ slightly from the authorized design, are faked proofs from the rejected dies. The striking of the medals from the approved dies was done at the Calcutta Mint, and the dies are still in custody there.

The invasion of Afghanistan was undertaken for the purpose of dethroning Dost Mahomed, and reinstating the exiled Shah Shujah. The Army of the Indus was composed of two corps under the command of Sir H. Fane, C.-in-C. in India. The Bengal column concentrated at Ferozepore in December, 1838, and was to form a junction with the Bombay column, under Sir John Keane, on the Indus.

The raising of the Siege of Herat led to a reduction of the invading army, the 3rd Infantry Brigade of the Bengal column was left at Ferozepore, and Sir H. Fane relinquished the command to Sir J. Keane.

The Indus was crossed at Bhakkar, which fortress was taken possession of, and the army commenced its painful march through the Bolan Pass to Quetta. The losses in baggage, transport and followers from marauders were enormous, the troops were half starved, and the immense army of followers almost entirely so, as they were put on quarter rations. At Quetta the 2nd Infantry Brigade (Major-General W. Nott) was left in garrison and the march resumed to Candahar.

The 37th B.N.I., a detachment of Shah Shujah's force, and all the battering train were left at this latter place, as it was understood that Ghuznee, which lay between the army and its objective, Cabul, was an insignificant fort.

On arrival at Ghuznee, the C.-in-C. found to his dismay a formidable fortress. The Chief Engineer gave his opinion that the proper course was to mask the fortress and continue the march on Cabul. Sir J. Keane made the disconcerting answer that this course was impossible as the army had provisions for *two days only*. Capt. Thomson thereupon stated that the only course open was to attempt to seize the fortress by a *coup de main*.

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Making a very careful reconnaissance on the 21st July, he ascertained that the Cabul gate was the only one which had not been built up, and he laid before the General a scheme for blowing this gate open and seizing the fortress by assault. The General approved the plan (none other was possible), which was to be carried into execution at 3 a.m. on 23rd July. Cavalry and artillery were posted in suitable positions while the storming column made its desperate venture.

The advance explosion party consisted of Capt. A. C. Peat, Bombay Engineers; Lieut. H. M. Durand, Bengal Engineers; Lieut. N. C. Macleod, Bengal Engineers; and 3 sergeants, and 18 sappers carrying 300 lbs. of powder, with 6 men of the 13th L.I. Their escort consisted of 300 men of the 13th L.I. who extended and kept up a fire on the parapets.

Then came the advance party of the light companies of the 2nd Foot, 17th Foot, and Bengal European Regiments and one company 13th L.I., guided by Lieut. J. L. D. Sturt, Bengal Engineers, and commanded by Colonel Dennie, of the 13th L.I.

Next followed the storming column, guided by Capt. Thomson, the Chief Engineer, and commanded by Brigadier Sale, consisting of the remainder of the 2nd, 13th, 17th and Bengal European Regiments; while lastly there was a native reserve under Brigadier Roberts composed of the 16th, 35th and 48th Bengal N.I. The whole of the European infantry of the army was thus thrown into the storming column.

Durand laid and fired the charge, and he himself has told the story of how nearly the whole scheme failed through the chances of night operations and stray casualties. Fortunately the "almost" failure turned into a "complete" success, and Ghuznee fell.

The fall of Ghuznee was a staggering blow to Dost Mahomed. Cabul was occupied without opposition, Shah Shujah was installed on the throne, and after some desultory fighting Dost Mahomed surrendered himself and was deported to India.

GHUZNEE.

Investment, 21st July; Assault, 23rd July, 1839.

Troops present on these dates, and entitled to the medal:—

Lieut.-General Sir J. Keane, Commander-in-Chief.

Major-General J. Thackwell, Commanding Cavalry Division.

Bengal Column.—Major-General Sir W. Cotton.

Cavalry:—Brigadier R. Arnold, 16th Lancers.
H.M. 16th Lancers.
2nd Bengal Light Cavalry.
3rd Bengal Light Cavalry.
4th Local Horse (Skinner's), detachment.

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Artillery :—Lieut.-Colonel P. L. Pew.
2-2nd Brigade Bengal Horse Artillery.
2-6th Brigade Bengal Foot Artillery.
Engineers :—Capt. G. Thomson, Chief Engineer.
2nd and 3rd Cos., Bengal Sappers and Miners.
Infantry :—
1st Brigade :—Brigadier R. H. Sale, 13th Foot.
H.M. 13th Foot.
16th B.N.I. and 48th B.N.I.
4th Brigade :—Brigadier A. Roberts,* European Regiment.
1st Bengal European Regiment.
35th B.N.I.

Bombay Column.—Major-General T. Willshire.
Cavalry :—Brigadier J. Scott, 4th Light Dragoons.
H.M. 4th Light Dragoons (2 squadrons).
1st Bombay Light Cavalry.
Poona Horse (detachment 300 strong).
Artillery :—Brigadier T. Stevenson (in chief command).
3rd and 4th Troops Bombay Horse Artillery.
2-2nd Battn. Bombay Foot Artillery.
1st Co. Golundaz Battalion.
Engineers :—Capt. A. C. Peat.
Infantry :—Brigadier J. G. Baumgardt, 2nd Queen's.
H.M. 2nd Queen's Regiment.
H.M. 17th Foot.
19th Bombay N.I.

Note.—The 2nd Bengal Light Cavalry was disbanded for cowardice at Parwandara, 2nd November, 1840.

The 2nd Infantry Brigade (Major-General W. Nott), consisting of the 31st, 42nd, and 43rd Bengal N.I., had been left at Quetta and elsewhere.

The 3rd Infantry Brigade never advanced beyond Ferozepore.

The 37th Bengal N.I. from the 4th Brigade was left at Candahar with the 4-2nd Battn. Bengal Artillery ; and other units and details not mentioned here were left behind at Quetta, in Scinde or elsewhere.

Casualties.—The total casualties on the 21st and 23rd July amounted to 18 men killed, 20 British officers and 153 other ranks wounded, 2 men missing.

A large portion of Shah Shujah's Force under the command of Major-General E. H. Simpson was present also and received the medal.

This force was raised in India, officered by British officers (assisted by a sprinkling of British N. C. officers), and paid by the Indian Government ; it was intended to form the nucleus of the Shah's future army.

* Father of F.M. Lord Roberts.

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On 23rd July, 1839, the British *personnel* and units of the force were as follows :—

Shah Shujah's Force, 23. 7. 1839.

Major-General E. H. Simpson, 19th B.N.I., Commanding.
Capt. J. Griffin, 24th B.N.I., A.D.C.
Capt. T. McSherry, 30th B.N.I., Brigade-Major.

Horse Artillery	Capt. W. Anderson, Ben. Art.
	Lieut. G. L. Cooper, ,, ,,
	Lieut. F. Turner, ,, ,,
1st Cavalry	Capt. J. Christie, 3rd Ben. L. C.
2nd Cavalry	Lieut. W. Anderson, 59th B.N.I.
	Lieut. D. Gaussen, 42nd B.N.I.
1st Infantry	Capt. J. D. D. Bean, 23rd B.N.I.
	Lieut. P. Nicholson, 28th B.N.I.
	Sergt.-Major W. Mathews.
2nd Infantry	Capt. C. G. Macan, 16th B.N.I.
	Lieut. J. Hoppe, 16th B.N.I.
	Sergt.-Major T. Smith.
3rd Infantry	Capt. J. H. Craigie, 20th B.N.I.
	Lieut. R. McKean, 17th B.N.I.
	Sergt.-Major N. McDoudd.
4th Infantry (Ghoorkas)	Capt. I. H. Handscomb, 26th B.N.I.
	Lieut. T. E. Moorhouse, 35th B.N.I.
	Sergt.-Major R. Young.
5th Infantry	Capt. J. Woodburne, 44th B.N.I.
	Lieut. J. K. Spense, 20th B.N.I.
	Sergt.-Major W. Fitch.
Commissariat Agent	Capt. H. Johnson, 26th B.N.I.
Medical Establishment	Surgeon J. Forsyth, Ben. Med. Est.
	Asst. Surgeon G. Rae.
	,, ,, C. Mackinnon.
	,, ,, H. Baddeley.

The force was increased to a total strength of

2 troops Horse Artillery.
Mountain Train.
A corps of Shah's Own Artillery.
A battalion of Sappers & Miners.
2 regiments of Cavalry.
6 battalions of Infantry.

The British *personnel* of officers and N.C. officers was increased also.

The fate of the contingent was as follows :—

The 4th Infantry was destroyed at Charikar in November, 1841, particulars of which are given below.

The 6th Infantry was destroyed in the retreat from Cabul, together with half the corps of Sappers & Miners, half the Mountain Train, and the small corps of Shah's Own Artillery.

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The 3rd Infantry was taken on to the strength of the Bengal Army.

The 5th Troop, 1st Brigade, Bengal Horse Artillery, was formed from the Shah's Horse Artillery, and the 7th and 8th Companies, Bengal Sappers & Miners, from the remnants of the Shah's Sappers & Miners in 1842. The remaining corps were disbanded.

The commanding officers of the force at the end of 1841 were as follows :—

Brigadier T. J. Anquetil, Commanding.
Horse Artillery.—Capt. W. Anderson.
1st Cavalry.—Capt. J. Christie.
2nd Cavalry.—Capt. W. Anderson.
Mountain Train.—Capt. J. B. Backhouse.
Shah's Own Artillery.—Lieut. R. Warburton.
Sappers & Miners.—Capt. G. Broadfoot.
1st Infantry.—Capt. J. Griffin.
2nd Infantry.—Capt. C. G. Macan.
3rd Infantry.—Capt. J. H. Craigie.
4th Infantry.—Capt. C. Codrington.
5th Infantry.—Capt. J. Woodburne.
6th Infantry.—Capt. P. Hopkins.

No medal was given for the assault and capture of Khelat (Baluchistan) on 13th November, 1839, although it is borne as a distinction on the colours of the regiments engaged; and occasionally an unofficial bar engraved " Khelat " is found on a Ghuznee medal.

The troops detached for this service (under the command of Major-General T. Willshire) were :—

2 guns 3rd Troop, Bombay Horse Artillery.
4 guns 1st Troop, Shah's Horse Artillery.
Detachment Bombay Engineers & Sappers.
2 rissalas 4th Local Horse (Skinner's).
H.M. 2nd and 17th Foot (343 and 400 strong).
31st Bengal N.I.

Casualties.—31 killed and 107 wounded.

After the surrender of Dost Mahomed the Army of Occupation was largely reduced, the returning corps marching back to India through the Khyber Pass which had now been opened. The remaining garrison was scattered throughout Afghanistan, at Candahar, Khelat-i-Ghilzie, Ghuznee, Cabul, and Charikar.

Continual desultory fighting had continued throughout 1840–1, but the garrison was being further reduced by the marching of Sale's brigade from Cabul toward India, when the storm burst in October, 1841, sweeping away the garrisons of Cabul, Charikar and Ghuznee, and driving Sale's brigade to take refuge in Jellalabad. In Southern Afghanistan Khelat-i-Ghilzie held out, and at Candahar Nott kept the field the whole winter, though all communications with India were cut.

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The story of the unfortunate results of the first attempts to relieve Jellalabad by Brigadier Wild, and to reinforce Nott at Candahar by Major-General England are well known, as also the second successful efforts by Pollock and England respectively. Jellalabad was relieved by Pollock on 16th April, 1842, nine days after the famous sortie of 7th April, and England reached Candahar on the 10th May. After three months of indecision the Government of India approved Pollock's plans for an advance on Cabul and for Nott's "retirement" to India *viâ* Cabul and the Khyber Pass. The subsequent operations of both Generals were entirely successful; and it only remains to enumerate the various corps who took part in the first disasters and subsequent successes.

Troops Destroyed at Charikar, November, 1841.

The 4th Shah's (Ghoorka) Infantry, under Capt. C. Codrington, and a detachment of the Shah's Own Artillery.

Only the Political Officer (Major E. Pottinger), one officer of the 4th Shah's Infantry (Ensign J. C. Haughton) and one Ghoorka, succeeded in escaping to Cabul; one or two other natives escaped independently and 165 Ghoorkas were rescued in 1842 by Haughton, after Pollock's advance to Cabul.

Troops Destroyed near Cabul, January, 1842, *under Major-General W. G. K. Elphinstone.*

The numbers given below are the approximate strengths of the corps on commencing the retreat from Cabul, 6th January, 1842.

1-1st Brigade Bengal Horse Artillery (90 men, 6 guns), Capt. T. Nicholl.

Half Shah's Mountain Train (3 guns, 30 men), Lieut. C. A. Greene, Bengal Artillery.

Shah's Own Artillery, Lieut. R: Warburton,* Bengal Artillery.

Half Shah's Sappers (240 men), Lieut. W. Bird, 30th Mad. N.I.

Detachment Bengal Sappers & Miners (20 men) attached to the A.Q.M.G.

2nd Shah's Cavalry (500 men), Capt. W. Anderson, 59th B.N.I.

5th Bengal L. Cavalry (260 men), Lieut.-Colonel R. E. Chambers.

Det. 1st Irregular Cavalry
Det. 4th Irregular Cavalry } Skinner's Horse (140 men).

The late Envoy's Escort (70 sabres).

H.M. 44th Foot (600 men), Major W. B. Scott.

5th Bengal N.I. (700 men), Major S. Swayne.

37th ,, ,, (600 men), Major C. Griffiths.

54th ,, ,, (650 men), Major W. Ewart.

6th Shah's Infantry (600 men), Capt. P. Hopkins, 27th B.N.I., and details of other corps.

* Father of Colonel Sir R. Warburton, K.C.I.E., Political Officer, Khyber Pass, 1879—1897.

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Colonel J. Shelton, 44th Foot, was acting as Brigadier, and Brigadier T. J. Anquetil commanded Shah Shujah's force.

The casualties during the three months preceding the retreat had been very heavy; 101 British officers were killed in and near Cabul between 12th October, 1841, and 14th January, 1842.

Major-General Elphinstone died in captivity.

N.B.—Pollock recovered in September, 1842, 34 British officers, 12 ladies, 22 children, 1 warrant officer, 7 men of the 13th Foot, 38 men of the 44th Foot, 6 Europeans of the Bengal Horse Artillery, 2 European clerks, and many hundreds of Sepoys and followers.

Troops Destroyed at Ghuznee, March, 1842.

27th Bengal N.I., Lieut.-Colonel T. Palmer.

Six British officers of this regiment (including the future hero, John Nicholson) were recovered by Pollock, and 327 Sepoys by Nott in September near Ghuznee.

From the above it may be seen that the popular statements of the British losses are greatly exaggerated. The total number of the troops (British and Native) destroyed in Afghanistan during this period may be reckoned at 900 Europeans and 4,500 Natives at the outside, of whom nearly all the Europeans and 3,600 Sepoys were killed at Cabul and in the retreat towards Jellalabad. These numbers do not, of course, include the followers of the army, large numbers of whom perished or were taken prisoners and sold into slavery.

JELLALABAD.

Defence under Sir R. Sale, 12th November, 1841, to 16th April, 1842:—

Garrison:—

H.M. 13th Foot.
5th Bengal Light Cavalry (1 squadron).
2nd Shah's Cavalry (1 rissala).
2-6th Battn. Bengal Artillery.
Two men of the 1-1st Brigade Bengal Horse Artillery.
Half the Shah's Mountain Train.
Half the Shah's Sappers (Broadfoot's).
35th Bengal N.I.
Detachment 6th Shah's Infantry (doing duty with Mountain Train).
Sergt.-Major of 37th B.N.I. (who escaped from Cabul), and details.
Followers—682 armed, 630 unarmed.

Casualties, 22nd February, 1842, to 7th April, 1842:—

1 British officer and 35 men killed.
7 ,, officers and 141 other ranks wounded.

Four guns were recaptured in the sortie of the 7th April.

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For their gallantry during the war in Ava, 1824–6, and in the defence of Jellalabad, the 13th Foot were given the title of " Prince Albert's " Light Infantry, and their facings changed from yellow to blue.

A large number of the Native officers of the 35th B.N.I. were recommended for the Orders of Merit, and British India for their gallantry.

Jellalabad.—Medals were issued to the surviving members of the garrison on December 14th, 1842, prior to their triumphal entry into Ferozepore. All these medals were unnamed. The dies are at the Calcutta Mint and are now cracked. An " unofficial " die has been made by some unknown person; but the difference can be easily detected.

In his order dated 17th December, 1842, Lord Ellenborough stated that medals would be sent in due course to the relatives of soldiers of the garrison who had deceased on or after April 7th, 1842; and as in his letter to the Court of Directors dated 19th October, 1842, he had asked for a new medal to be struck, it is almost certain that the relatives of deceased soldiers received the second or " Flying Victory " medal, as it is called. A considerably larger number of " Flying Victory " medals were issued than is generally supposed.

Medals seem to have been struck off and impressed for most of the officers of the garrison, although some never applied to have their original medals exchanged. The 13th Foot sailed from India for England in December, 1844, leaving behind 446 men who had exchanged into other regiments serving in the country. Some time after their arrival home a return was sent in giving the names of those men still in the regiment who had not *yet* exchanged their medals. This list comprises nearly 200 men, and medals were struck and impressed for all of them, mounted with the China 1842 suspender. About 50 of these men are noted as having exchanged their medals *after* the date of this return, and 139 were sold to a Mr. Nash in 1860 by the India Office.

Many men of the 13th Foot wore the 2nd Jellalabad medal with a parti-coloured crimson and blue ribbon, but the authority for this is not known.

The actual number of men entitled to receive the Jellalabad medal was 2,596. The exact distribution of this number is not available, but the following is a very close approximation :—

H.M. 13th Foot	780
5th Bengal L. Cavalry	160
2nd Shah's Cavalry	100
2-6th Battn. Bengal Artillery	150
Shah's Mountain Train	65
Shah's Sappers (Broadfoot's)	400
35th Bengal N. Infantry	900
Details	41

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A few " Flying Victory " medals exist with the obverse of the China 1842 medal, bearing the legend " Victoria Regina " instead of " Victoria Vindex." It can be stated *definitely* from the examination of records that in some cases such medals were late re-issues, and it is probable that all were ; and this remark applies to the few similar medals given for Cabul, Candahar, etc.

With regard to the " Candahar " medal it is to be noted that the dies are kept in India. This fact seems to have been unknown at the Royal Mint, for to meet the demand for two re-issues in later years (one an officer's and the other a private's medal) two medals were struck from the " Candahar, Ghuznee, Cabul " die, and the words " Ghuznee, Cabul," erased. I am not aware that either of these medals have been met with by collectors. No other re-issues of " Candahar " medals appear to have been made in England.

At least two dies were used for the " Candahar " medals, as minute differences can be seen by a careful observer.

CABUL, 1842.

Troops that formed " The Avenging Army " under Major-General G. Pollock's Command.

Cavalry :—Brigadier M. White, 3rd L. Dragoons.
H.M. 3rd Light Dragoons.
1st and 10th Bengal Light Cavalry.
3rd (Tait's) Irregular Cavalry.

Artillery :—Major H. Delafosse, Bengal Artillery.
3-1st Brigade and 3-2nd Brigade Bengal Horse Artillery.
2-2nd Battn. and 4-6th Battn. Bengal Artillery.
Mountain Train (2 guns).
" E " Co. Syce Drivers.

Engineers :—Capt. F. Abbott, Bengal Engineers, Chief Engineer.
5th Co. Bengal Sappers & Miners.
A corps of Pioneers (Lieut. F. Mackeson).

Infantry Division :—Major-General J. McCaskill, 9th Foot.

*2nd Brigade :—Brigadier J. Tulloch.
H.M. 9th Foot.
26th and 60th Bengal N.I.
5th Co. Bengal Sappers & Miners.

3rd Brigade :—Brigadier C. F. Wild.
30th, 53rd, 64th Bengal N.I.

4th Brigade :—Brigadier T. Monteath, 35th B.N.I.
H.M. 31st Foot.
6th and 33rd Bengal N.I.

* For 1st Brigade see below.

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A Sikh contingent with Capt. H. M. Lawrence,* Ben. Art., and Capt. J. Ferris' Afghan Jezailchis co-operated.

N.B.—(*a*). The Brigadier of the 4th Brigade was commanding his regiment, 35th N.I., in Jellalabad. (*b*). The 31st Foot arrived a good deal later than the 9th Foot, and did not share in the forcing of the Khyber Pass and Relief of Jellalabad in April. (*c*). Only the 3rd Company of the 6th B.N.I. received the medal; while of the 33rd B.N.I. only two companies were at the forcing of the Khyber Pass and Relief of Jellalabad.

After the Relief of Jellalabad on 16th April, the garrison was amalgamated with Pollock's force, and H.M. 13th Foot, the 35th B.N.I., Broadfoot's Sappers, and the Khyber Rangers (Capt. H. P. Burn, 1st B.N.I.) formed the 1st Brigade under Sir R. Sale's command.

The only unit of the Jellalabad garrison that did not advance with Pollock (other than details) was the remnant of the 2nd Shah's Cavalry. This corps did not receive the Cabul medal; nor was it granted to the friendly Afghan levies that accompanied Pollock, or to Mackeson's semi-civil corps of pioneers: only the British officers of these corps received the medal.

Troops at CANDAHAR, January, 1842, under Major-General W. Nott.

1st (Bengal) Irregular Cavalry (Skinner's).
1st Shah's Cavalry.
1st and 2nd Troops Shah's Horse Artillery.
Half 4-2nd Battn. Bengal Artillery.
3-1st Battn. Bombay Artillery.
H.M. 40th Foot.
2nd, 16th, 38th, 42nd, and 43rd (six companies only) Bengal N.I.
1st, 2nd, and 5th Shah's Infantry.

Garrison of KHELAT-I-GHILZIE, under Capt. J. H. Craigie, 3rd Shah's Infantry.

Half 4-2nd Battn. Bengal Artillery.
Det. Bengal Sappers and Miners (from the 2nd and 3rd Companies).
3 companies 43rd Bengal N.I.
3rd Shah's Infantry.

Nott relieved the garrison of Khelat-i-Ghilzie on May 26th and brought it back to Candahar.

* Later Sir Henry Lawrence, K.C.B., killed at Lucknow.

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Reinforcements from INDIA, under Major-General R. England, which arrived at Candahar on 10th May, 1842.

1st Troop Bombay Horse Artillery.
3-2nd Battn. Bengal Artillery.
Half C Co., Madras Sappers and Miners.
3rd Bombay Light Cavalry.
Poona Irregular Horse (one rissala).
H.M. 41st Foot.
25th Bombay N.I.
Bombay L. Infantry Battalion (probably formed from the light companies of the battalions stationed in Upper Scinde, viz. :—6th, 8th, 20th, 21st and 25th Bombay N.I.).

N.B.—105 men of H.M. 41st Foot and details did not arrive at Candahar till 27th June, 1842.

Troops that returned to India, viâ Quetta, under Major-General R. England, on 10th August, 1842.

1st Troop Shah's Horse Artillery.
Half the 4-2nd Battn. Bengal Artillery.
1st Shah's Cavalry (2 rissalas).
Poona Irregular Horse (1 rissala).
1st, 2nd, and 5th Shah's Infantry.
25th Bombay N.I.
Bombay Light Infantry Battn.
Sick and details of other corps.

Troops that Marched from CANDAHAR on GHUZNEE and CABUL, with Major-General W. Nott, 10th August, 1842.

Artillery :—Major F. S. Sotheby, Ben. Art., Commanding.
1st Troop Bombay Horse Artillery.
2nd Troop Shah's Horse Artillery.
3-2nd Battn. Bengal Artillery.
Det. 4-2nd Battn. Bengal Artillery doing duty with the 3-2nd Battalion.
3-1st Battn. Bombay Artillery.
Engineers :—Major E. Sanders, Bengal Engineers, Chief Engineer.
Det. Bengal Sappers & Miners (from the 2nd and 3rd Cos.).
Half C Co., Madras Sappers & Miners.
Cavalry :—Capt. C. H. Delamain, 3rd Bombay Light Cavalry, Commanding.
1st (Bengal) Irregular Cavalry.
3rd Bombay Light Cavalry.
1st Shah's Cavalry (less 2 rissalas).

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Infantry :—

1st Brigade :—Brigadier G. P. Wymer, 38th B.N.I.
H.M. 40th Foot.
16th and 38th Bengal N.I.
3rd Shah's Infantry.

2nd Brigade :—Brigadier L. R. Stacy, 43rd B.N.I.
H.M. 41st Foot.
2nd, 42nd, 43rd Bengal N.I.

N.B.—In the cavalry action at Oosman-Khan-ki-karez, on 28th August, 1842, the Subadar-Major of the 3rd Bombay L. Cavalry, "who wore the medal for Seringapatam," was killed.

On his march from Candahar to Cabul, Nott captured ten guns, and recovered 327 men of the 27th Bengal N.I., many of whom did duty with other corps thenceforward.

The casualties in action sustained by Nott's force, between 1st January, 1842, and the 17th September, the date of his arrival at Cabul, were some 70 killed (including 3 British officers) and 330 wounded.

For their gallantry in this campaign the 2nd and 16th Bengal N.I. were made Grenadiers, and the 38th, 42nd and 43rd Bengal N.I. were constituted Light Infantry.

For their share in the defence of Khelat-i-Ghilzie the 3rd Shah's Infantry was brought on to the strength of the Bengal Army as "The Regiment of Khelat-i-Ghilzie," and still exists as the 12th Khelat-i-Ghilzie Regiment.

Jellalabad, 1842.—First Medal.

1·5-in. diameter, silver.

Obverse.—A mural crown, "JELLALABAD."

Reverse.—The date "VII. April 1842."

Mounting.—A straight silver brooch with a loop in the centre engaging a small silver ring from which the medal is suspended.

N.B.—This original mounting, being rather weak, is not often seen.

Second Medal.

1·4-in. diameter, silver.

Obverse.—Crowned head of Queen Victoria.
Legend "Victoria Vindex."

Reverse.—Victory flying over the fort of Jellalabad.
Inscription, "JELLALABAD VII April MDCCCXLII."

Mounting.—German silver bar, secured to the medal by two concealed pins.

N.B.—This also is a weak mounting, and not often seen.

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Khelat-i-Ghilzie, 1842.

1·4-in. diameter, silver.

Obverse.—A shield inscribed "KHELAT-I-GHILZIE," surrounded by a laurel wreath, and surmounted by a crown.

Reverse.—A military trophy, "INVICTA MDCCCXLII."

Mounting.—A steel bar and clip.

Candahar, Ghuznee, Cabul, 1842.

Four medals, 1·4-in. diameter, silver.

Obverse.—As for the 2nd Jellalabad medal.

Reverse.—(*a*). "CANDAHAR 1842" within a wreath, surmounted by a crown.

(*b*). "CABUL 1842" within a wreath, surmounted by a crown.

(*c*). "CANDAHAR GHUZNEE CABUL 1842" within a wreath surmounted by a crown.

(*d*). "GHUZNEE" "CABUL" each within a wreath: a crown above; "1842" below.

Mounting.—Steel bar and clip.

The ribbon for all these medals, including the Jellalabad and Khelat-i-Ghilzie medals, is the military ribbon of India, 1¾ in. wide. This ribbon was designed by Lord Dalhousie for the Jellalabad medal, crimson shading into yellow, and yellow into blue. It was intended to be the "military" ribbon of India, just as the crimson ribbon with blue edges was the "military" ribbon of Great Britain; and as such was worn with the Scinde and Gwalior medals of 1843. It was revived as the ribbon for the bronze star granted for the march from Cabul to Candahar, 1880, but in a narrower width. Many men of the 13th Foot wore a parti-coloured crimson and blue ribbon with the *second* Jellalabad medal, but the authority for this is not known.

Khelat-i-Ghilzie.

932 medals in all were struck, as follows:—

Staff and details	7	
4-2nd Battn. Bengal Artillery..	86	(of whom 1 officer and 43 men were Europeans).
Bengal Sappers and Miners	23	(Details from Nos. 2 and 3 Companies).
43rd Bengal N. Infantry ..	247	(3 companies).
3rd Shah's Infantry	569	

With few exceptions most of the above received the "Ghuznee-Cabul" medal as well.

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The following list gives the number of medals struck for Major-General Nott's force :—

	Candahar, Ghuznee, Cabul.	Ghuznee, Cabul.	Candahar.
Staff and details	23	3	5
H.M. 40th Foot	669	3	64
H.M. 41st Foot	494	105	26
1st Troop, Bombay H. Artillery	—	138	—
3-1st Battn. Bombay Artillery	91	25	2
3-2nd Battn. Bengal Artillery..	17	87	1
4-2nd Battn. Bengal Artillery..	10	38	28
1st Troop, Shah's H. Artillery	—	—	127
2nd Troop, Shah's H. Artillery	121	—	1
Bengal Sappers and Miners (details 2nd and 3rd Cos.) ..	3	24	—
Madras Sappers & Miners, C Co.	1	28	—
3rd Bombay Light Cavalry ..	—	354	—
1st Bengal Irregular Cavalry ..	282	17	17
1st Shah's Cavalry	469	1	198
2nd Bengal N.I.	893	4	65
16th ,, ,, ...	795	4	31
38th ,, ,, ...	854	5	107
42nd ,, ,, ...	852	1	79
43rd ,, ,, ...	637	169	37
1st Shah's Infantry	—	—	640
2nd ,, ,, ...	—	—	592
3rd ,, ,, ...	—	521	—
5th ,, ,, ...	—	—	595
Totals	6,211	1,527	2,615

It is to be noted that this list does not include the " Candahar " medals to which detachments from the Poona Irregular Horse, 25th Bombay N.I. and the Bombay Light Infantry Battalion were entitled. The omission seems to have been accidental, owing to their not having come under Nott's direct personal command, and correspondence ensued on this subject. The actual number of " Candahar " medals issued to them later on is not discoverable, but the claim was allowed.

A " Candahar " medal was issued later on to Sir R. England, who scarcely came within the terms of Lord Ellenborough's order of 4th October, 1842, authorizing the medal ; and his first application for it seems to have been rejected.

Of the 64 " Candahar " medals struck for the 40th Foot, 42 were for the relatives of deceased officers and soldiers, and 22 for sick, etc., who returned to India from " Candahar " *viâ* Quetta. In the same way most of the " Candahar " medals struck for the 41st Foot were for the relatives of deceased soldiers.

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The 105 men of that regiment who received the "Ghuznee-Cabul" medal arrived in Candahar late in June, some seven weeks after the main body: as also did the two officers and one man (three in all) of the 40th Foot who received the "Ghuznee-Cabul" medal. The late Field Marshal Sir N. B. Chamberlain and his brother, General Sir C. T. Chamberlain, served as subalterns with the 1st Shah's Cavalry, one brother receiving the "Candahar-Ghuznee-Cabul" medal, and the other that for "Candahar."

The distribution of the "Cabul" medals struck is given below:—

Staff, etc.	38
3-1st Brigade Bengal H. Artillery	129
3-2nd ,, ,, ,, ...	139
2-2nd Battn. Bengal Artillery	97
2-6th ,, ,, ,, ...	123
4-6th ,, ,, ,, ...	109
Mountain Train	56
E Company Syce Drivers	153
H.M. 3rd Light Dragoons	489
1st Bengal Light Cavalry	453
5th ,, ,, ,, ...	142
10th ,, ,, ,, ...	498
3rd Tait's) Irregular Cavalry	739
H.M. 9th Foot	831
H.M. 13th Foot	745
H.M. 31st Foot	826
6th Bengal N.I. (3rd Co. only)	112
26th ,, ,, ...	1,004
30th ,, ,, ...	920
33rd ,, ,, ...	947
35th ,, ,, ...	837
53rd ,, ,, ...	915
60th ,, ,, ...	1,012
64th ,, ,, ...	927
5th Company, Bengal Sappers and Miners ..	125
Shah's Sappers (Broadfoot's)	375
Total ..	12,741

The numbers of medals struck (especially "Candahar" medals) may surprise a good many collectors, but the comparative rarity is to be gauged by the number of *European* recipients, which may be estimated approximately as follows:—

Khelat-i-Ghilzie	55
Candahar	130
Ghuznee-Cabul	360
Jellalabad	800
Candahar—Ghuznee—Cabul ..	1,400
Cabul	3,500

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All the medals for this campaign (except the 1st Jellalabad medals) were engraved before issue, with the exception of many of those given to the Shah's troops, and *many officers' medals.*

The total number of medals was therefore approximately 27,000, viz. :—

Jellalabad	.. 2,596
Khelat-i-Ghilzie	.. 932
Cabul	.. 12,741
Candahar	.. 2,615
Ghuznee, Cabul	.. 1,527
Candahar, Ghuznee, Cabul	.. 6,211
Total ..	26,622, exclusive of some later claims.

The amount of ribbon ordered was 14,000 yards, from which it appears that half a yard was issued with each medal.

There are few medals that repay careful study in a greater degree than those given for this campaign or to which so much interest is attached.

Engineer Officers who served in Afghanistan, 1839–42.

(*a*). 1839.

G. Capt. G. B. Thomson, Bengal Engineers, Chief Engineer.
G. Lieut. J. Anderson, Bengal Engineers, Surveyor.
G. ,, H. M. Durand, Bengal Engineers, Surveyor.
— ,, J. Laughton, Bengal Engineers, Field Engineer (left at Bhukkur as Garrison Engineer).
— Capt. E. Sanders, Bengal Engineers, Sappers and Miners (sent from Candahar on mission to Herat).
G. Lieut. J. L. D. Sturt, Bengal Engineers, Sappers & Miners.
G. ,, N. C. Macleod, Bengal Engineers, Sappers & Miners.
G. ,, R. Pigou, Bengal Engineers, Sappers & Miners.
G. ,, J. S. Broadfoot, Bengal Engineers, Sappers & Miners.
G.K. Capt. A. C. Peat, Bombay Engineers (wounded).
— Lieut. C. F. North, Bombay Engineers, Field Engineer (to Herat with Sanders).
G. Lieut. W. F. Marriott, Bombay Engineers, Field Engineer (wounded).
G.K. Lieut. F. Wemyss (Senior), Bombay Sappers & Miners.
— ,, J. D. Cunningham, Bengal Engineers, Political Assistant with Colonel C. M. Wade (to Cabul *viâ* Khyber Pass in 1839).

G. denotes presence at the Storm of Ghuznee, 23rd July, 1839.
K. denotes presence at the Storm of Khelat, 13th November, 1839.

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(*b*). 1840–42.

Lieut. J. S. Broadfoot, Bengal Engineers, killed at Purwandara, 2. 11. 40.
,, R. Pigou, Bengal Engineers, killed by explosion at fort gate in Nazian Valley, 24. 2. 41.
,, J. L. D. Sturt, Bengal Engineers, killed in retreat from Cabul, 9. 1. 42.

Defence of Khelat-i-Ghilzie, 1842.

Lieut. (Major) R. Leech, Bombay Engineers, Political Officer, and another Bombay Engineer who was Executive Engineer.

With Major-General Nott, "Candahar, Ghuznee, and Cabul, 1842."

Major E. Sanders, Bengal Engineers, Chief Engineer.
Lieut. C. F. North, Bengal Engineers.
,, (Major) R. Leech, Bombay Engineers, Political Officer.
,, T. Studdert, Bombay Engineers.

With Major-General Pollock, "Cabul, 1842."

Capt. F. Abbott, Bengal Engineers, Chief Engineer.
Lieut. J. W. Robertson, Bengal Engineers.
,, A. G. Goodwyn, ,, ,,
,, J. R. Becher, ,, ,,
,, J. S. Alexander, Bengal Engineers, with Brigadier Wild at the first attempt to relieve Jellalabad (with Pollock later (?)).

Plates.

Ghuznee, 1839, obverse and reverse.
1st Jellalabad, 1842, obverse and reverse.
2nd Jellalabad, 1842, obverse and reverse.
Khelat-i-Ghilzie, 1842, obverse and reverse.
Afghanistan, 1842, 4 reverses, "Cabul," "Candahar—Ghuznee—Cabul," "Ghuznee—Cabul," "Candahar." (Obverse similar to 2nd Jellalabad medal).

(*To be continued*).

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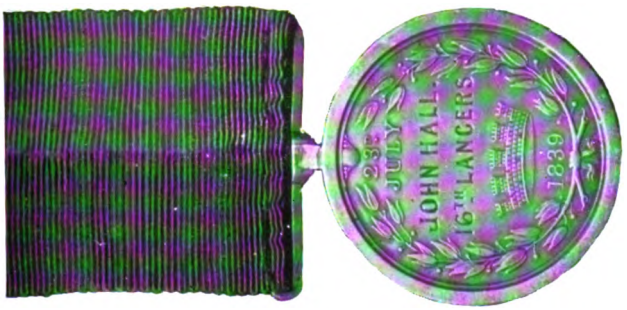
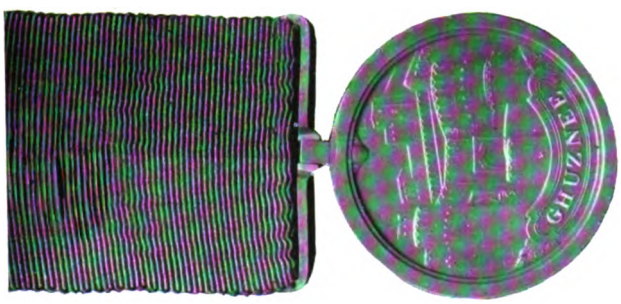
EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.



GHUZNEE. 1839.



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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

JELLALABAD. 1842.

(First Medal).

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

JELLALABAD. 1842.
(Second Medal).

KHELAT-I-GHILZIE. 1842.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

AFGHANISTAN. 1842.
(Obverse as in Plate V.).

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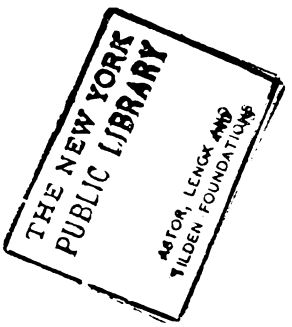

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General Sir Edward Pemberton Leach, V.C., K.C.B., K.C.V.O.

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MEMOIR.

GENERAL SIR EDWARD PEMBERTON LEACH, V.C., K.C.B., K.C.V.O.

EDWARD PEMBERTON LEACH was the second son of the late Lieut.-Colonel Sir George Archibald Leach, K.C.B., R.E.

He was born in Londonderry on the 2nd April, 1847, and was educated at Sir Roger Cholmeley's school at Highgate, passing direct from there into the Royal Military Academy—8th out of a batch of 34—just after having reached the qualifying age of 16. He passed out 5th, obtaining a commission in the Royal Engineers in April 1866.

His life at Chatham was that of most other young R.E. officers who are fond of games, society, dancing and other amusements, and although he did not play cricket for the Corps, he played a good deal for the S.M.E., and while there was elected a member of the M.C.C.

He left Chatham in September, 1868, and embarked for India in the following November, proceeding to join the Bengal Sappers and Miners, who at that time were employed in roadmaking in the hills below Chakrata.

In March, 1869, he was sent to command one of the detached companies at Rawal Pindi, where he remained for a year, employing his spare time in learning the language, sketching and schooling his ponies over a " jump " course which he had made in the compound of the bungalow he shared with some artillery friends. He was fortunate in purchasing a very good arab, which later on won him several races.

Having applied to be appointed to the P.W.D. he was sent from Rawal Pindi to Morar, where large barracks were being constructed for British troops, and worked there for a year or so, but he found the barrack work monotonous and was glad to accept an appointment on the Survey offered him by Colonel Thuillier, the Surveyor-General.

Almost immediately on being gazetted, he joined the Survey party detailed for the Cachar Column, under General Bouchier, R.A., about to be sent to punish the Lushais—who had been raiding the tea plantations, R. G. Woodthorpe being the other assistant.

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From a purely Survey point of view the expedition was not so successful as had been hoped.

The Lushais gave more trouble than was expected. Consequently the range of Survey operations was much restricted. However the output of work was considered very creditable under the circumstances and he received the thanks of the Secretary of State for India and also of the Government of India, together with the Frontier Medal and Clasp.

By the 28th April, 1877, he and his friend Woodthorpe were back in Shillong.

From there after two months at Mussoorie he proceeded to join the Survey party under Holdich in Central India.

The following story told by Holdich is typical :—

" Edward Leach was with me as assistant in Central India, 1872–73. Being naturally gifted with great energy and boundless activity he was almost an ideal assistant. He would have quite reached that ideal but for his passion for sport and the temptation which beset him on all sides in such a country as Central India. We had a good time there and it is with reference to that good time that I am tempted to tell just one ' tiger ' story because it stamped in my mind once and for all both the character and quality of Edward Leach. I had arranged a tiger beat and had called in Leach from a distant camp to join me. The scene of the beat was a line of jungle fringing a river. We took it turn and turn about for one to watch the exit at certain partially cleared spaces on the river bank while the other came through with the two elephants and beaters to prevent any break back. It was Leach's turn to watch the exit—mine to manœuvre the elephants. Soon I heard two shots ahead—just two and no more. Hurrying up I came upon Leach seated in a most insecure position, his face beaming with delight as he exclaimed ' I've shot two tigers.' It was now my business to find those two tigers. One presented no difficulty. There was a rush and a skirmish and a large tigress rolled over into the river, where I left her. Number two gave the trouble. I searched till I was sick of it. At last I ventured to suggest to Leach that he must have seen the same tiger twice. This was too much for him. His language was explosive and he remarked that if I did not believe him he would never come shooting with me again. As he had come at my invitation and had been let off a day's work with the theodolite, I naturally felt a bit hurt and suggested that as he was so certain about it he had better show me where he had last seen the tiger. It was a foolish challenge which he accepted at once. He bounced down, crawled under a thick bush, and exclaimed " This is whereabouts he was and by God here he is still." What was I to do ? The bush was too thick to see into from the howdah. Nothing was to be seen of Leach except his two legs sticking out. To have fired at random into the middle

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of the bush would have been sheer madness, for, as it happened, the tiger was quite alive, not much damaged by the first shot and crouched with his head about a yard or so from Leach's. Just one extension of his great big paw and he could have smashed Leach's head in like a nutshell. There is not much doubt that he would have done it too had Leach backed out an inch. Soon a voice came up from the bush 'What shall I do now?' I said 'Pull up your rifle and shoot him.' Slowly—slowly, inch by inch, Leach pulled his rifle up by his side till he got it to the tiger's head and he then literally blew his brains out whilst they were still staring into each other's eyes. Then he backed out and with his face expanding with a broad smile he remarked "I told you he was there." "

On completion of their camp work the party returned to Mussoorie and civilization for the hot weather.

He had one more cold weather in Central India with Charles Strahan, an ardent sportsman, and then took a run home on three months' leave. On his return he joined a party in Rajputana under George Strahan, paying a visit to Roorkee *en route* to see old friends and have a day's pig-sticking.

During that cold weather he met Oliver St. John, R.E., whom he was destined to see a great deal of later on at Kandahar. April, 1875, found him in Simla, where he was most successful with his "stable" at the horse show, taking the first prize in the classes for arabs and ponies, the Viceroy being second in the one case and the Commander-in-Chief in the other. From 1875—1877 he alternated between Rajputana and Simla, taking furlough home in November of the latter year.

He remained at home until October, 1878, and then returned as Private Secretary to the late Sir James Caird, who was deputed from the Land Office as Famine Commissioner.

The second Afghan War, however, now broke out, and resigning his appointment with Sir James Caird, he joined Tanner's Survey Party in the Khyber. Sir James, in writing to his father, said: "He has been most useful to me in every way. I have found him a most pleasant friend and zealous assistant. I shall miss him very much. I think your son knows everybody in India."

He was promoted Captain at this time, which, as it turned out, was most opportune. With his wonted energy he took every opportunity of prosecuting his Survey work, and joined the various small punitive expeditions against offending tribesmen—including the one into the Bazar Valley under General Tytler. His last expedition, and one which was to prove an eventful one for him, was a reconnaissance into the Shinwari country. One day while surveying in the hills he was attacked by a large body of tribesmen. His escort consisted of only 40 men of the 45th Sikhs, under Barclay, and 30 sowars of the Guides Cavalry, under Hamilton (subsequently killed with

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Cavagnari in Cabul). There was nothing for it but to retire. Hamilton pushed on ahead, joined his horses which had been left some little distance back and reached the plain in safety.

Leach and Barclay brought up the rear and for 2 miles everything went well, but when they got close to the plain the tribesmen closed round and a rush was made by a party of them. This Leach was able to check—emptying his revolver in their faces; but then Barclay was wounded, mortally as it turned out, and the enemy, seeing this, again closed up and prepared for another rush. Leach, seeing that the moment was a critical one, called on his men to fix bayonets and with a few men charged back to meet the tribesmen and hold a small knoll—hoping to give time for the men who were carrying Barclay to push on. A hand-to-hand encounter followed in which Leach floored one man with the butt end of a rifle he had picked up, receiving a cut on the left arm in exchange. A Sikh then gave him a handful of cartridges, with which he shot three more—one after the other—and being well backed up by his men, the enemy took to their heels and fled.

The Shinwaris themselves rendered him a flattering tribute when, later on, they told another Survey officer that had it not been for the " Sahib " they would have killed the whole detachment.

For his gallantry on this occasion he was awarded the Victoria Cross which he received at the hands of Queen Victoria, together with Reginald Hart, on 9th December, 1879. He was also mentioned in despatches and received the brevet of Major.

The wound in his arm took longer to heal than was expected, so on the recommendation of the medical authorities he went home, having in consequence to decline the appointment of Private Secretary to Sir Robert Egerton, Lieut.-Governor of the Punjab. This injury unfortunately resulted in a permanent stiffness of the left elbow joint, though this never seemed to trouble him much.

February, 1880, found him on his way to Kandahar for Survey work under St. John, who was in political charge there. In June he made a successful reconnaissance with 150 men to Giriskh, on the Helmand, 35 miles west of Kandahar, gaining a knowledge of the country which subsequently proved most useful.

On the 4th July he left Kandahar again for Giriskh with a force under General Burrows to arrest the march of Ayub-Khan, who was advancing on Kandahar.

On the 27th July, 1880, the Battle of Maiwand was fought. What followed is a matter of history. The British force was totally defeated, and retreated in dire confusion in the direction of Kandahar —42 miles away—a mere struggling mass half dead with thirst and fatigue.

The part taken by Leach in this action is described in Colonel Hanna's book, *The Second Afghan War*. The latter writes:

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" Great emergencies are parents of great deeds, but in the published and unpublished accounts of the battle and retreat, two names stand out pre-eminently, those of Major E. P. Leach, V.C., and the Roman Catholic Chaplain, Father J. Jackson. No man in the force knew the district in which the Battle of Maiwand was fought, and through which the retreat to Kandahar was conducted, so well as Leach, and no man could have turned that knowledge to better account. From the moment he succeeded the late Sir John Slade, K.C.B., as orderly officer to General Burrows he was that General's right hand, and when the course of events separated the two, on his own initiative he carried help and guidance wherever help and guidance were most needed and he vied with Slade in succouring the wounded and encouraging the downhearted.

Slade in describing the retreat wrote : " It certainly was a terrible sight—men laid down and refused to be carried, helped or assisted in any way—only asked to be allowed to die. Again and again did Leach and I, who were almost the last in, implore and insist upon their persevering a little longer."

Leach's horse had been wounded during the action, but managed to carry him all through that day and the 42 miles retreat afterwards. On reaching the supporting troops under General Brooke, which had been sent out to cover the retreat, Leach with others volunteered to return along the line of retreat to bring in any wounded, or men who had succumbed through fatigue, and save them from being cut up by the villagers who followed up the retreating force.

On his return to Kandahar he was appointed Brigade-Major, R.E., and worked indefatigably during the siege in the defences of the place.

In writing about the disastrous sortie on the 16th August under Brooke he bore testimony to the gallantry of Turner-Jones and Waller of the R.E., both of whom he said thoroughly deserved the V.C. and for whom several times later on he tried unsuccessfully to get it, though thay had been recommended for it locally—and whom, when they brought in a wounded man, were heartily cheered by all the men on the ramparts.

On the arrival of Roberts' force he prepared a large scale map of the country over which it was evident the coming battle would be fought and was with that General during the fight. After the defeat of Ayub-Khan, he remained at Kandahar under General Hume till the following May, before taking over charge of the Poona Survey Party, with Hobday of the Indian Staff Corps as his assistant.

From Poona he was transferred to Calcutta, and after spending a very pleasant cold weather there obtained six months' leave to England.

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For his services at Maiwand and during the retreat, Leach was given the brevet of Lieut.-Colonel, Slade and he being the only two who received rewards for that action.

He was also three times mentioned in despatches and received the thanks of the Government of India for his Survey work and the medal with clasp.

It was in October of that year (1882) that he met his wife, eldest daughter of Sir Thomas Bazley, Bart., of Hatherop Castle, Gloucestershire, and their marriage took place in the following January.

At the end of his six months' leave he reverted to home service and joined at Chatham as a Captain, R.E., but a Lieut.-Colonel by brevet.

From Chatham he went to Shorncliffe, picking up the 24th (Field) Company, R.E., at Aldershot.

At Shorncliffe he spent two years and then embarked with his company on the 18th February, 1885, to join the force under Sir Gerald Graham for field service at Suakim, having with him the following officers :—Capt. Dickinson, Lieut. McCarthy, Lieut. Godby, Lieut. Buckland, Surgeon Cree, A.M.D.

Colonel Bevan Edwards was the C.R.E. of the force and Capt. Smith-Rewse the Brigade-Major. From the moment they landed the 24th Company were busily employed on various works connected with camps, construction of field redoubts, railway work and water supply, etc., including an expedition to Hasheen to make a fort there—and where there was a small action.

On 22. 3. 85, 100 men of the company accompanied the force under Sir John McNeill towards Tamai. On reaching a point 5 miles from Suakim, subsequently called Tofrek, the force halted and proceeded to make zaribas. In the middle of their work without any warning, as far as the 24th Company and the working parties on the northern side were concerned, they were attacked by a large number of Arabs. Everybody rushed to get their arms. Some succeeded, others did not.

A covering party of the 17th Native Infantry at once fell back on the zariba. A portion manned one face, the remainder broke completely through and retreated followed by the Arabs.

The camel drivers, dhoolie bearers and other followers were thus left exposed and in one confused mass followed the native infantry through the zariba, carrying with them a large number of men who might otherwise have been able to form up. The confusion was absolute, but fortunately the Marines held their own, while a rallying square of two companies of the Berkshire Regiment with some 30 R.E. under Godby drove back a vigorous attack of the Arabs and the crisis passed.

Another party of some 20 men, under McCarthy, who were carried

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away by the rush through the zariba, subsequently fought their way back and joined their comrades.

The camels all this time were under a cross fire and the majority were shot down, and the R.E. horses would have shared the same fate had they not been cut loose by the drivers under Dickinson's orders. Leach was conspicuous outside the zariba endeavouring to regulate the fire from it, which was endangering the groups outside, at great personal risk to himself, not only from the Arabs, but also from the fire from his own side.

On the 2nd April the company accompanied Sir G. Graham's force to Tamai, but after this the 24th Company had no more fighting. Before leaving Suakim they were inspected by Lord Wolseley who was very complimentary and told them that Sir John McNeill had described their services as " invaluable " and that he was proud to see them turn out so well. Meeting Leach afterwards in Cairo he was again full of praise about his and his company's share in the action and said that he was particularly struck with the way the company pulled themselves together and set to work again directly the fight was over.

Sir Gerald Graham in bidding farewell to the company also alluded in complimentary terms to their conduct at the zariba. Colonel Leach was twice mentioned in despatches, received the Egyptian Medal with two clasps, also the Khedive's Star, and the C.B. for his gallantry at the zariba.

From Suakim the 24th Company was sent to Cairo, and Leach was given the command of a mixed brigade of English and Egyptian troops—with the rank of Colonel on the Staff—at Korosko, a place of some strategical importance, where the desert route from Abu Hamed strikes the Nile.

On arrival there in July, 1885, he at once set to work to get the place into order and into a proper state of defence. He was able to obtain a liberal allowance of ball ammunition with which constant practice in the hills round, and at floating targets in the Nile was carried out. General Grenfell, after having inspected the place, described it as being " in a most creditable state." Leach remained at Korosko until March, 1886, when it was abolished as a command.

After a few months at home he again returned to Egypt, having been appointed to command the English Brigade at Assouan. Here again he found plenty of scope for his energy.

He established a system of octroi and with the funds thus obtained improved the sanitation of the place and built a river wall. He also was energetic in stamping out the illicit liquor traffic carried on by the Greek and Levantine merchants and did a great deal to improve the accommodation for the troops.

While here he won the Egyptian Derby with an arab he had

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bought from Sir George Greaves, late Chief of the Staff to Sir Gerald Graham.

In April, 1887, his command came to an end, and he returned to England, being posted to Plymouth as division officer in charge of the Sound defences, first of all under Colonel Hewett, and then under Colonel Stewart, to both of whom he was senior in Army rank, as he was in fact to most of the commanding officers in the division. Here he spent six years. He had hard work at times, but his life was uneventful and he did not get many opportunities of handling troops except when Sir Richard Harrison, the G.O.C., was able, owing to his seniority, to give him command of one of the opposing forces at the divisional manœuvres.

In April, 1893, he left for Halifax, Nova Scotia, as C.R.E., a station he himself described as a delightful one. The work there was chiefly of the routine order, but there were occasional variations in the shape of night attacks by the fleet on the forts and endeavours by the torpedo boats to slip past the guns.

As Halifax at that time was both a naval and military station, the social life was a gay one and of course there was most excellent fishing to be had.

The R.E. stationed at Work Point, Esquimault, being under the C.R.E., Halifax, Colonel Leach in 1894 crossed the Rocky Mountains to Victoria on inspection duty, a journey at that time of seven days and nights, stopping at Winnipeg and Banff *en route*.

In October, 1897, he was promoted Major-General and returned home in December of that year.

Having been selected as President of the Committee appointed to report on the military organization of Canada and of the defence of her frontier, he returned to that country in July, 1898, the other members of the committee being Colonel Dalton, R.A., Colonel Lake and Capt. Graham White, R.N. On completion of his report, for which he received the thanks of the C.-in-C. and of the Secretary of State for the Colonies, he returned to England.

In April, 1899, he took over the command at Belfast as G.O.C. Northern Division in Ireland, serving for the greater part of his five years there under H.R.H. the Duke of Connaught.

A brother officer who served with him in Belfast writes as follows:—

"He was of course very clever and very quick to grasp a subject. He would pick up a big file of correspondence, read it through, send for his shorthand writer and dictate a long three-page letter which would require no after 'editing.'

Military topography was one of his hobbies, and woe to the man who could not read a map or turn out a decent military sketch. Another hobby which he would exercise at manœuvres was to

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remove all the officers (supposed to have been killed or wounded) and leave operations to be carried on by the N.C.O.'s. This generally led to somewhat amusing situations.

He was the founder of Bally Kinler Camp, on an excellent piece of training ground just north of Dundrum Bay, and in starting this camp, where the troops from Belfast and Holywood go to in the summer for company and battalion training and musketry, General Leach did a real good turn to soldiers quartered there which will not soon be forgotten. This training ground is also used for the annual training of some of the special reserve battalions in the north of Ireland and is a great boon to them."

While in Belfast he had the honour of attending His Majesty the late King on the occasion of his visit to open a new hospital there, receiving the C.V.O. on this occasion.

A few months after completing his time at Belfast, General Leach was appointed to the Scottish Command and took up his residence in Edinburgh. His four years in Scotland were years of hard work. It fell to his lot to organize the territorial system in the north—no light task.

During that time also he took a keen interest in the erection and equipment of the Victoria School at Dunblane for the sons of Scottish soldiers, which was opened by His Majesty the late King Edward.

While holding the command in Scotland, General Leach was annually summoned to spend a Saturday and Sunday at Balmoral, and on the first of these visits was made a K.C.V.O. A year later he became a K.C.B., was promoted Lieut.-General on 3rd April, 1905, General on 31st August, 1910, and retired on the 4th September, 1912.

It was at this time that he first took a golf club in his hand, and from that day became an ardent votary of the "Royal and Ancient Game."

He died very suddenly of heart failure on the 27th April, 1913, at Cadenabbia, on Lake Como, in his 67th year, leaving one son, who is now in the R.H.A. in India, and two daughters.

General Leach never held a high command in the field, but he had all the requisite qualifications. He had a thorough knowledge of Survey work, had had a good deal to do with coast defences, an extensive experience of field engineering with its many ramifications, was a good rider, most energetic and determined, very quick at putting his ideas into writing, and not afraid of responsibility. He did not know what fear was and kept his head in a crisis.

He was a staunch friend and was always ready to take up the cause of any officer or man under his command whose merits

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he thought had not, perhaps, received the consideration they deserved.

Diners at the Corps Dinner will no doubt recollect the advice he gave to young officers, never to be ashamed of " bricks and mortar," but to learn their work and do it, and above all to recollect how much of any success they may achieve they owe to the loyalty of their N.C.O.'s.

Within the last few years he had the unique experience of proposing, as senior officer present on the Active List, the toast of the " Old Officers," which toast was responded to by his father, Sir G. A. Leach, who was the senior officer on the Retired List and who only survived his son by two months.

H.P.L.

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TRANSCRIPT.

HOW THE ANGLO-GERMAN BOUNDARY IN SOUTH WEST AFRICA WAS MADE.

(Translated from the *Militär Wochenblatt*).

On June 27th, 1913, ten years elapsed since Mark No. 36 of the boundary line between German South West Africa and British Bechuanaland was erected on the southern tropic. This ended the work of the Anglo-German Boundary Commission, which had gone on without interruption —with the exception of a 3-months interval—since November, 1898. A few months later the Bondelzwaarts insurrection broke out, which was the beginning of our long native war in South Africa.

The following account is intended to give an insight into the work of this commission, as, owing to the outbreak of the war, nothing concerning it has hitherto been published beyond the purely technical matters, which have appeared in scientific journals.

At the beginning of the boundary survey, the development of the land had not made much progress. There were no railways, the line Swakopmund-Windhoek was only begun, even the telegraph line, which was built before the railway, only reached Windhoek in August, 1901. At that time this railway was the only modern means of communication in the country. Communication with other places was limited by the speed of horses or oxen. A helio line between Windhoek-Koetmanshoop was added in 1902. Even war despatches took a considerable time to go from Warmbad across country. Apart from the military and administrative centres the colony had little help to offer.

On this account the boundary work was made very difficult, more especially as the boundary line, the 20th and 21st meridian and its connection on the 22nd of latitude, with the exception of the southern parts, was rather remote from even such resources as were found elsewhere in the country. The question of transporting the indispensable technical apparatus, of victualling men and animals and so forth became of necessity exceedingly difficult in such a rough country as that near the boundary.

Added to this there were many technical considerations, *e.g.* the Kalahari with its dry, flat and thickly wooded steppes which afforded many obstacles. Other obstacles and difficulties had to be contended with in connection with the nature of the land, such as the lack of any kind of maps, want of intelligent help (only natives of different tribes), climate, water, cattle plagues, etc.

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The white staff consisted of four "Schutztruppenreiter" (troopers) who had to be constantly relieved; it was very difficult at first to make use of their untrained substitutes. Thus it is not surprising that the work on the boundary line, which looks so simple on the globe, afforded many surprises and difficulties apart from the cost of time and money.

On July 1st, 1890, an agreement was made in Berlin between the British and German Governments in connection with the eastern boundary of our territory. The result of the negotiations was the boundary line to be seen to-day on the map. At that time there was no topographical survey, at least no trustworthy one; von François had established the boundary only by means of chronometrical measurements, but it was considerably out in many places.

Many difficulties soon cropped up about the ownership of several water places. The German troops had for the time being to quit Olifantskloof and Rietfontein, because the claim, that they were in British territory, could not be disproved.

Now England had at this time guaranteed to carry the triangulation begun at the Cape, as far as the "Ecke" (corner) in order to come to a definite understanding regarding the question, but sufficient account had not been taken of the difficulties which the Kalahari put in the way of the continuation of the work.

Then it was that Sir David Gill, H.M. Astronomer at the Cape, made a most acceptable suggestion. He proposed, that the British and the German nations, being specially interested, should undertake the work on the German side hand in hand. So through him, and then through the German authorities, arrangements were made in Berlin, and after much discussion the matter was settled. The work might have begun as early as in 1896 had not the rinderpest broken out, which rendered postponement necessary.

Each country chose an officer for the survey. The technical management was conducted in Cape Town by Sir David Gill and the German Consul-General. Major H. D. Laffan, R.E., was the British representative from beginning to the end of the commission, and on the German side was Leutnant Wettstein, whose place was afterwards taken by the writer, at that time Oberleutnant à la suite Pion.-Bataillons, No. 4, who was sent out to the colony to survey in some other parts of our colony.

The British had begun their work on a large scale according to geodetic principles. These principles require, as is well known, that the whole of the earth surface should be covered with exact triangles in order to obtain the earth's dimensions, etc. In the east the English had already measured from Rhodesia up to Egypt. On the western side of Africa a beginning had been made for the same subsidiary scientific purpose, and the triangulation had been carried as far as Rietfontein (Mier). If the work was to be homogeneous, it was necessary for Germany to measure on the same principles, although the difficulties of such an exact survey on the German side were very considerable. Of course the triangulation chain, which was made, was very advantageous for Germany, as it became the basis for every future survey.

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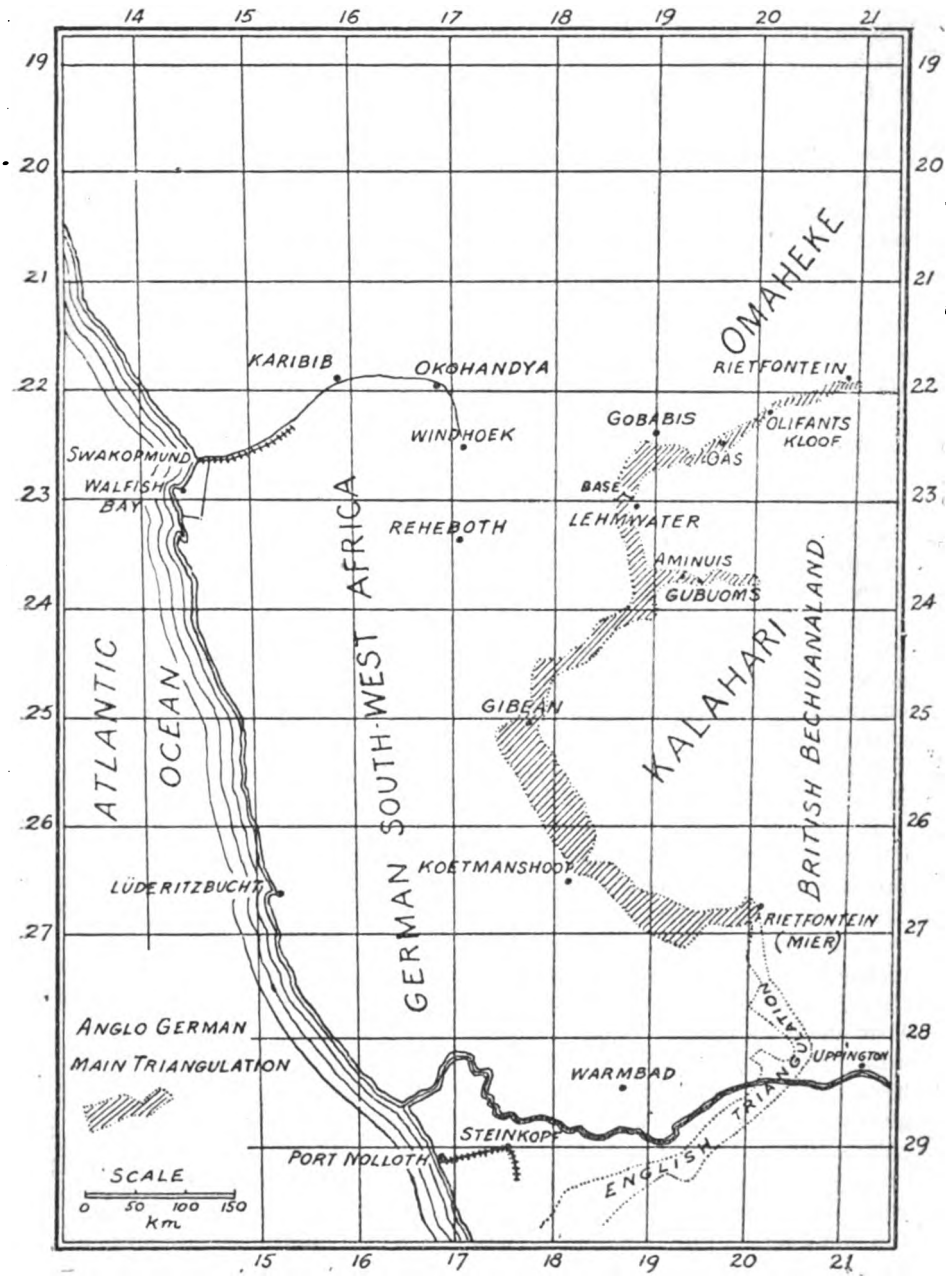

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The triangulation chain goes at first, for reasons which will be easily understood, round the Kalahari. Its only purpose was to reach one point of the 20th meridian, etc., which gave the exact position of the places above mentioned. The survey joins the English triangulation chain, and is made on the principles of British triangulation work.

To be able to have some test in the long chain of measurement, a latitude and azimuth were taken at different points. Also in the latitude of Lehmwater a new base line was measured according to a new method. From somewhere about here the chain curved in the direction of the places in question and into the central Kalahari. The branch near Aminuis was not made until 1903.

When the " Ecke " was enclosed by triangles the commission went south to begin, after several tests which could not be put off, the real establishment of the boundary. This work, begun just on New Year's Day, 1902, would have been comparatively simple, had it not been for the Boer War and an abnormal drought. Both these circumstances placed the commission several times in most difficult situations, and the German representative was once in danger of dying of thirst.

The line marks (numbered iron plates made in Berlin), which were to be fixed on iron posts 12 ft. high, were erected in the northern parts of the line about 10 k.m. apart, in the southern at intervals of about 3 k.m. (2 miles).

On the 19th April No. 133 on the northern bank of the Oranje was erected. The German boundary in the south is the northern bank of the river, as was arranged at the conference, but no mention was made as to the level of water! The British declared it was high water. In our native war this unsettled question was the cause of some curious situations.

Exceptional hardships were produced by the chaos of the Oranje Mountains, which is described in our war correspondence.

In the north the commission could only proceed as far as Mark No. 67. The equipment was no longer suitable, after the many years of use, to proceed through high sand dunes, also the Boers were too active and the cattle could hardly be kept alive, on account of the indescribable drought.

As the work in the Kalahari could only be carried out in the height of the rainy season, which would have been over long before arriving there, the commission decided to go on leave for 2½ months. The Boer War made the way to Cape Town through Uppington quite impossible, and, just as the commissioners were about to go by Steinkopf, the Boers blew up the railway bridge, obliging them to reach the coast by the almost impassable way to Lüderitzbucht. In the meanwhile the column was taken up to Gobabis, where the cattle were to recover.

At the end of November, 1902, the German representative began the work again near Olifantskloof. When his English colleague arrived, the boundary of that territory was—with an enormous amount of hardship and trouble—provided with marks. There were no water melons (" Tsammas ") at all that year, and constantly suffering from want of water, in the thickest Kalahari wood, through which they had for miles to make cuttings for sights, the commissioners were always in the greatest distress.

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By the 14th April the almost impossible was achieved: the "Ecken" and the 22nd of latitude were marked as far as was proposed. Olifantskloof was found to lie well within the British territory, whilst Rietfontein was about 8 to 11 k.m., and Sandfontein a few hundred metres within the German sphere.

Although the equipment was at first sufficient when working in the south of the territory, it was quite unfitted for working in the Kalahari. The work had to be done in too many places with quite different technical means. Only ox-waggons and carts were to be had. The horses were reduced through "Sterbe"; for the water the commission was dependent only on "vleys," as Olifantskloof, and another water place found on the German side, were not permanent and only contained a few buckets full. Blasting was tried without success. When the vley-water had evaporated the cattle, with the exception of a few head, had to be taken to Rietfontein about 100 k.m. away in order to save them. It was a constant struggle for existence. In 1901 it was the same, when at one time everybody had to hurry to Oas, as between Rietfontein and that most eastern military post there was no water to be found anywhere. The commission was obliged to remain in such a neighbourhood for weeks and months. Provisions had to be taken for many months for six Europeans and about 40 natives, also the technical equipment and the heavy iron marks and cement and water casks, etc. All these stores had to be loaded on ox-carts to the exclusion of even the most modest comforts for the Europeans, who had to live a regular bushman's life for many months.

Had the commission been provided with camels and with the possibility of unlimited relays, as the German troops afterwards fought in the Kalahari during the war, its work would have been considerably lightened, but the limited funds prevented these much needed supplies. From 150 to 190 k.m. of sandy "path" separated us from Gobabis, even if it had been possible to procure anything there.

At last in May, 1903, the branch east of Aminuis could be triangulated. Immediately afterwards the boundary marks were erected there, the last of which was the aforementioned No. 36.

During this part of the work even greater difficulties and hardships had to be undergone, as Gubuoms was the only place with water, and it was situated 56 k.m. (35 miles) off as the crow flies from the boundary. The growth became thicker and higher and there was no elevated ground. The technical work got more and more difficult. Diminishing the staff to less than a dozen men enabled the commissioners to continue the work, during which they utilized two or three iron cabin trunks as reservoirs for water (they could be locked!). These were filled once a week; the oxen had to trek through the sandy Kalahari 130 k.m. without being watered. These reasons explain the fact, that the boundary marks were on this part of the line comparatively few.

That the work was finished then (July, 1903) is greatly due to the able assistance of Mr. Heatly, Government Land Surveyor, who had been sent out to accelerate the work by the British Government in March, 1903. An indefatigable worker, he, together with Major Laffan, underwent the greatest hardships.

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If anything had happened to delay the work—the British Commissioner used to call our colony "The Land of Delays"—we all, at least the German military staff, would certainly during the rising of the natives have been the victims of the 28 Hereros belonging to the Commissioner's staff. It is a well-known fact that British were spared by the Hereros. Thus only one trooper of ours was afterwards killed by the Hereros in Oas.

When the work was completed, Major Laffan and Mr. Heatly went through the southern part of the German and British territory to Vrijburg and Cape Town, while the German representative took the remainder of the stock alone to Windhoek, where they were to be sold by auction. The whole of the equipment had been supplied and kept up by Germany, and Great Britain paid half the expenses. Now the work was at an end the money obtained by the sale of the equipment had to be divided, but as there were a great many difficulties in the way, the sale could not be completed until September 3rd, 1903.

After the final reckoning had been made, the German representative had left Swakopmund on 20th October, and while he was sailing to Cape Town the insurrection of the Bondelzwaarts broke out. He learnt of it from English papers in Cape Town.

With the exception of Major Laffan, only one trooper (Unteroffizier Bott) had been able to hold out from first to last. The British representative merits the highest praise, especially on account of the phenomenal brain work done during five years in connection with the survey.

During the campaign the survey of our colony was undertaken on a large scale by the "Preussische Landesaufnahme" in Berlin. The boundary triangulation is connected and enclosed in their system. The surveying and topographical measurement is still going on, and the "Schutzruppe" helps in exploring the land. There are already very good maps of our territory to-day.

Probably it will soon be necessary to establish the line of the "Caprivizipfel" and of the northern parts of the Omaheke, and to close the gaps left open by us in the centre of the Kalahari with the marks put down in Rietfontein and Aminuis ready for use.

OTTO DOERING,
Hauptmann und Mitglied des Kgl. Preuss. Ingenieur-Komitees.

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NOTICE OF MAGAZINE.

REVUE MILITAIRE.

May, 1913.

JAPANESE MANŒUVRES, 1912.

The Japanese manœuvres took place from the 15th to 19th November, northwest of Tokio, in the flat region between the Arakawa, the Tamagawa, and the mountains east of the Atsugi, Hachioji, Ogimachiya, Matsuyama road. The Emperor directed in person, assisted by the Chief of the General Staff and an umpire staff.

The opposing armies were similar and were composed of :—Two divisions, one brigade of cavalry, one brigade of artillery, one brigade of heavy (5-in.) howitzers with ammunition column, one army telegraph detachment.

The Southern Army under General Oshima (Gisho) consisting of the Guard and 1st Divisions formed the 2nd Army of the Blue Force, the 1st Army being imaginary. Similarly the Northern Army under General Oshima (Hisanao) consisted of the 13th and 14th Divisions and formed the 4th Army of the Red Force, the 3rd Army being imaginary.

Divisions were composed as follows :—Two infantry brigades each of eight battalions and a machine-gun detachment, one cavalry regiment (three squadrons), one regiment of artillery (six batteries and ammunition column), one battalion of engineers (three companies), one telephone section.

The independent artillery brigades were each of two regiments, and batteries had four guns and two wagons. No bridging units were attached, as all streams were fordable. No dirigibles or aeroplanes took part, nor was wireless apparatus used except in a very limited sense for experimental purposes. Ammunition and supply columns except as mentioned were imaginary.

The manœuvres, which in the Japanese Army are chiefly intended as exercises for the subordinate commanders and as a practical test of endurance for the rank and file, do not appear to have brought to light any noteworthy departure from the accepted principles ; as was the case during the Japanese War, there is still a tendency to reduce reserves to a minimum during the attack, although when on the defensive considerable reserves were kept in hand. In the decisive attack, we find the point of attack determined long beforehand and considerable depth opposite this point, the artillery being massed to support the attack. The action of advanced guards was always cautious, they were never committed until the main body had come up, and never, it appears, on the initiative of the advanced guard commander—when the situation was

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not clear, the Japanese practice was to carry out a " reconnaissance in force " or partial attack either by the advanced guard or another body of troops specially detailed, before the general deployment took place. Divisions covered a front of 3 to 5 miles.

NEW RUSSIAN RECRUITING LAW.

An account is given of the new Russian regulations dated 23rd June, 1912, by which the strength of the annual contingent is considerably raised by including various classes such as doctors, schoolmasters, etc., not formerly subject. The object is to raise the general standard by allowing a larger proportion to be refused as unfit. The new law is noteworthy from its special provisions with regard to Jews, an increasing proportion of whom have hitherto evaded service.

THE ITALIAN MILITARY CO-OPERATIVE.

An interesting account is given of an Italian Military Society similar to the Army and Navy Co-operative Society, and the German Offizier-Verein.

BRAZIL.

A School of Aviation is to be formed as a private undertaking at Rio, and is to be taken over by the Government with the apparatus in five years' time.

June, 1913.

NORWEGIAN MANŒUVRES, 1912.

These are interesting as being the first test on a large scale of the Norwegian organization of mixed brigades of a composition somewhat analogous to the forces of New Zealand.

BELGIUM.

The Antwerp defences have been recently reorganized in seven sections, each under a general or senior officer. A flying company has been formed, consisting of a central flying school, and a certain number of squadrons each of four aeroplanes, with motor transport.

GERMANY.

A volunteer flying corps has been formed, the members of which engage to take part in army manœuvres (up to 10 days per annum) and to place their machines at the disposal of the Government in time of war. The corps receives £150 per machine, and the aviators £2 per diem while serving, and a lump sum of £10 for travelling expenses to the manœuvre area. Searchlight sections have been attached (April, 1913) to the Guard, 2nd, 3rd, 4th, 5th, 6th, 11th, 26th, 27th and one other pioneer battalions.

July, 1913.

The new German Army Law of 30th June, 1913, introduced in the spring of 1913, is discussed.

E.R.

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PERMANENT FORTIFICATION.

A Lecture delivered to No. 3 Senior Officers' Class, S.M.E., by MAJOR R. N. HARVEY, D.S.O., R.E.

THE most cursory glance at the past history of our Army, and its employment in warfare with civilized nations, will show the reader that every campaign on European territory has included the siege of at least one important centre. The siege operations of the Peninsula resulted in the creation of the School of Military Engineering in 1812. Siege operations, which have always figured in R.E. text books, have now been recognized in the *Field Service Regulations*, the text book of operations controlling the action of *all* branches of the Service, and since this is the case, surely it is not out of place for all arms to know something of the nature of the works against which these siege operations are to be conducted.

Before discussing permanent fortification of the present day, I think it will be instructive to glance over the history of that branch of military science, for by that means alone can we really grasp the why and wherefore of the present-day ideas.

Historically, fortification can be most easily divided into periods based upon the radical changes in the nature of the weapons with which it was confronted, namely :—

(1). The pre-gunpowder period.
(2). From the invention of gunpowder until the introduction of rifled ordnance.
(3). The invention of rifled ordnance to the present day.

1. *First Period.*—From the earliest times—as soon as man became able to build in stone—the wall has always been the most popular form of defence work. The most powerful engines that could be brought against such a form of defence was the battering ram or catapult. The introduction of a ditch limited the utility of the former, the damage caused by the latter was haphazard.

The form which the trace of the defences took was usually a rectilinear figure described round the object to be defended, strengthened at the angles and in long faces by towers which at once performed the duties of watch towers, sentry boxes and flanking defence.

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There was usually not much attempt at an active defence, for the possibilities of a successful sally through a narrow gateway and over a drawbridge were not inviting, and unless the reduction of a fortress was effected by stratagem or storm, the result of the siege operations usually depended upon the reserves of supplies and water of the garrison, and plague and pestilence in those days was also a force to be reckoned with by both sides.

2. *Second Period.*—With the introduction of gunpowder and guns firing cannon balls there came a change, but even then the change was very gradual, for the first terror produced by cannon was the moral effect of an iron ball rolling along the ground which could remove the arms and legs of those who got in its way; besides the early artillery was as dangerous to friend as to foe. After a while of course its effect on masonry was felt. In addition to this there was a desire on the part of the defence to take advantage of this new engine of offence. It was realized that the best effect was obtained by guns near the ground level, and that the plunging fire from a castle wall lost much of its potentiality as a destructive agent.

The result of this natural feeling was the introduction of low advanced works in front of the walls, generally near the entrances. In these works were placed the guns of the defence, from which both frontal and flanking fire could be obtained. These advanced works were the origin of the bastion.

As the guns of the attack gained in efficiency, so the popularity of lofty walls diminished, and the next great change in fortification is the disappearance of the wall into a deep ditch by which it was protected from direct fire and which in itself formed the main obstacle to the attack.

The Italians in 1540 were the first engineers to adopt the new system, and from that dates the bastion system of defence. We have an example of this earliest change at Berwick. The advantages of the system are obvious. All faces are intended to give mutual support, the bastions flank the curtain and the curtain the bastion, at the same time being capable of frontal fire to some extent.

Later on there arose various engineers on the Continent who sought to improve matters, but they devoted their efforts to the solution of the problem of the defence of the ditch and other faces by *flank* fire, and to securing the place against successful assault by retrenching every likely face. By their continued seeking after flank defence in any degree of complexity, and by their step-by-step defence, they produced such a veritable maze of works that the science of the engineer was swallowed up in the genius of the draughtsman.

The most familiar names of the improvers to the bastion trace are those of Vauban and Cormontaigne. As Sir G. Clarke says:

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"Vauban has by the irony of fate come down to us as the creative genius of defence, but the great work of his life is hardly known. He was in fact the first engineer who reduced the attack to a well-organized system which he demonstrated in a long series of successful sieges, which included fortresses of his own design, but this abstract science was almost completely eclipsed by the concrete fact that he covered France with fortresses, though half of them might be unnecessary and even undesirable."

That Vauban and his system dominated the science of permanent fortification from the 17th to 19th centuries, inclusive, there can be no doubt; even as late as 1840 the defences of Paris were designed on his lines, and the enciente of Antwerp proved the *pièce de résistance* in the syllabus of permanent fortification at the R.M.A. in 1886, though at that time the system was nearly 100 years out of date. If therefore we count the foundation of the bastion trace from 1540, it retained its popularity for 300 years.

In this same period of construction we must include a certain break away from Vauban, foreseen in 1776 by Montalembert, but not actually brought into being till 1828. But before this new school of thought materialized, there was a most original break away from the traditions of fortification in the Peninsula. I refer to the construction of the lines of Torres Vedras, ordered by the Duke of Wellington. In this scheme a line of 29 miles was held by a series of detached works which did not flank each other, and in some cases were more than a mile apart. The flank defence of ditches was attempted in a few of the redoubts, but in most the trace was based on the ground alone. The garrison was 1,600 men per mile, but Massena could not be induced to attack this line.

The words of Colonel J. T. Jones, one of the executive engineers, may be quoted here as they enunciate clearly the principles of modern fortification: "Throughout the whole front there was not a continuity of artificial line necessitating a single brigade to be kept out of column, and the works may be regarded as so much additional strength given to the Army without subtracting a man from its effective force. Indeed, the artificial defences of the lines altogether present a most favourable example of the engineer not in furtherance of, but invariably subservient to tactics, creating pivots and supports but never a tie or restraint on field movements."

Montalembert, whom I have just mentioned, advocated a return to a simpler trace, and introduced the German, or polygonal, or modern French system which now obtains generally. This was combined with a system of caponiers and counterscarp galleries by which the flanking of the ditches was secured. Posen was the earliest example of the polygonal system. Between Waterloo and Crimea, Germany fortified a great deal on these lines, and here again the tendency to

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exaggeration was developed. Enormous caponiers were built, which in themselves were veritable fortresses, for the purpose of dealing with the batteries of the attack which it was supposed would be established on the crest of the main ditch, thereby obscuring the original simplicity of design.

The next great siege of history was the Siege of Sebastopol. Here the works on the south face belonged to a design of 1828, which had been only partially carried out; in fact they consisted for the most part of buildings, officers' quarters and barracks intended to be in the gorge of the bastions. These were supplemented by ordinary earthworks, and it was to them that the successful continuation of the siege is due. Sebastopol was a complete triumph of the fortification of the soldier Todleben as opposed to that of the draughtsman.

3. *Third Period.*—Having now reached the commencement of the period when guns became rifled and the explosive more violent, and consequently the range and accuracy of firearms generally made great advances, let us look back and see what lessons history had brought forward to govern the design of permanent fortification and how they have been put in practice.

From the Peninsula we should have learned :—

(1). The bastion trace was condemned because frontal fire was sacrificed to flanking the ditches.
(2). That long untraversed faces were useless as positions for guns.
(3). Bombproof cover must be provided near guns and parapets.
(4). Embrasures were condemned as means of conducting shot into gun detachments.
(5). Unprotected escarp walls carrying parapets were useless.
(6). That when breaches *were* made they could be easily defended by extemporized retrenchments.

The Siege of Sebastopol gave the following :—

(1). There is no intrinsic defensive value attaching to monumental revetments or fantastic traces.
(2). Good earthworks with sufficient bombproofs near guns and parapet were sufficient to hold off attack.
(3). An obstacle under *close* fire is a strong obstacle.
(4). Field guns brought to a parapet during assault are very useful.
(5). Guns should not be placed where the detachments can be injured by bursts back from a building (Malakoff).

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With reference to (2), the Redan, Mamelon, and Malakoff were all successfully stormed during the temporary absence of their garrisons, and a few years later Drïppel fell from the same cause. The siege also brought to notice that the strength of a defence lies in its capacity to attack.

The French forts prior to the Franco-German War had received little or no revision for about 50 years, and they naturally bring out the same lessons as detailed above, especially as regards the active defence as exemplified by the Siege of Belfort and Paris. But in addition the following were taught :—

(1). That the enciente was impossible owing to the increased range and power of guns, and the damage to private property which induced the civilian population to bring unfair pressure on the commander of the fortress.

(2). Guns in exposed positions were useless, and must be either hidden or covered with armour or concrete.

(3). The reduit or keep was useless.

The second lesson was the commencement of the idea to put the guns outside works and conceal them, *i.e.*, the divorce of the distant defence from close defence.

In anticipation of a further development in explosives and ordnance the cupola first made its appearance in 1864, but it was not generally adopted until much later, 1886, when the idea was brought out by Schumann. The idea was that all guns should be mounted in cupolas either fixed or disappearing, thus obtaining the protection needed, but it takes little imagination to picture the difficulties attending such a system of defence even if adopted in a simpler form.

The cupola has been subjected to the ordinary run of madness, and one, Mougin, prepared a design for a fort entirely underground, a mass of concrete resembling an enormous mushroom, from different parts of the surface of which emerged cupolas with their guns ready trained to fire. There were no soldiers required for these forts—only mechanics.

Practical difficulties connected with the control of fire, arc of view, and the reduction in the rate of fire are the arguments against the use of cupolas, for the cost of one heavy gun in a cupola six firing *en barbette* could be provided.

Now, as regards the separation of the distant from the near defence which I mentioned just now, it means that the infantry garrison rifle fire should be entirely separate from that of the heavy artillery, and the present tendency is to make the redoubts for infantry only, with a few light guns for flank defence, while the heavy artillery is placed behind in the intervals hidden from sight in works or open batteries.

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The recommendations of the French commission in 1887 will show the trend of modern Continental thought on the subject of permanent fortification, which shows a remarkable change from Vauban's system.

Principal line of defence :—

1. *Point d'appui* 3,000 yards apart with intermediate works to flank intervals, each capable of all-round defence.

The *point d'appui* are self-contained works with concrete shelters, magazines, and barracks.

The ditches are flanked by caponiers or galleries.

Flanking fire on the intervals is provided from light guns in cupolas, hidden caponiers, or traditor batteries.

Wire entanglements hidden under crest of the glacis under close fire.

Armament :—Four 75-m.m. and two 6-in guns.

The intervals are occupied by troops in a position carefully selected beforehand but strengthened only by fieldworks.

In their Frontier fortifications the French have adopted this system in two long lines from Belfort to Epinal and from Toul to Verdun, with a view to presenting impenetrable barriers behind which mobilization and concentration can be completed, and at the same time the line of likely approach of an enemy is confined. The late General Langlois did not believe in this and compared it to the action of a beaten dog which hides behind a piece of furniture for safety. He advocated a system of large entrenched camps giving freedom for manœuvre for a large mobile force.

The Germans, however, have adopted a different system based no doubt on their confidence in their large numbers and their ability to find the men their system demands. Along their frontiers they are forming enormous fortified areas. The forts forming the defence line are called Feste, and are in themselves veritable fortresses; but how different from the old enciente or the detached work of former days. Here the area of each may reach 150 acres—five times larger than was considered desirable formerly—and we see the logical result of former teaching, the distant defence quite separate from the near, cupolas used where best suited, a strong obstacle round the entire group. No pains or expense are spared to make even these enormous works inconspicuous. A glance at the diagram of Metz will give a good example of the trend of modern continental ideas (*Plate* I.). Feste 7,000 to 10,000 yards apart and 14,000 from centre of city.

The following is a description by a French officer of the sequence of works one might expect to find if one walked through the lines of defence of a modern fortified area from the outside :—

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(1). Advanced posts in front of main line.
(2). Forts and intermediate posts of main line.
(3). Main artillery position with expense magazines and shelters for the men.
(4). Lines of railways connecting every point.
(5). Reserves and main magazines.
(6). 2nd line. 1st revision of original defence.
(7). 3rd line. The original enciente.

The last example of siege against permanent fortification is Port Arthur. Without going into the details of the siege, let us see what bearings the lessons of the past had on the design of the defences.

Looking at the map we see that in 1903 the work done was :—

(1). An enciente.
(2). Six large works and six intermediate, in most of which were placed the guns of the defence.

We have seen already that encientes were condemned in 1870–71 and also that the placing of guns in conspicuous works was condemned in the Peninsular War, Sebastopol, and 1870–71. This is only another instance showing how slowly lessons in fortification are learned.

The redoubts were of conventional type, polygonal trace, with deep ditches flanked by caponiers and counterscarp galleries. The works also were considerably strengthened by auxiliary works. The importance of the correct selection of the point of attack is fully brought out. East and West Pan Lung Shan being forts in the *main line* were taken by the Japs on August 22nd, but these were of no use to the successful attackers and the importance of 303-Metre Hill was not recognized till some time after. After its fall on December 5th events followed quickly, and the capitulation of the fortress was signed a month after.

The functions of the forts may be said to be as follows :—

(1). Denied the occupation of important points by Japanese.
(2). Compelled the enemy to resort to siege works to reduce them.
(3). Housed their garrisons and they were supplemented by field defences of all sorts.

The following points have been collected as interesting detail of the siege operations :—

Guns on conspicuous skyline were quickly knocked out.

The Japs mounted 18 11-in. howitzers in the field.

The Russians had similar heavy weapons in their coast defence but did not move them to the front.

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4 ft. 6 in. of concrete was proof against breaching, and sloping concrete surfaces induced ricochets.

Fieldwork bombproofs were opened out even when made with the heaviest timber, their value was increased by placing iron sheets below the baulks.

The value of a ditch as an obstacle and the security against assault of any work with a well-flanked ditch is brought home, and the efficiency of the defence of breaches by a retrenchment is again emphasized after 100 years.

The principles to be applied to all schemes of fortification are :— Permanent fortification can only be required to gain time, and time is only valuable in so far as

(1). The fortified state possesses resources which can be developed during the delay.
(2). The resources of the enemy can be so far exhausted in the process of capturing the fortifications that the balance of power sways to that of the defender.

As regards the defence, the successful defence of a fortress has in no case depended upon the peculiarities of the trace of its works but always

(1). On the spirit and capability of the commander and his troops.
(2). On their supplies and water reserve.
(3). On their reserves of ammunition.

From my remarks perhaps you have gathered that ever since the inception of the lines of Torres Vedras there has been a general wish to get more elbow room on the part of the defence in order to be able to get room to move ; this we recognize as the birth of the offensive-defensive which is to-day's creed, and by looking at the diagrams of the various periods we can see how that desire has developed till culminating in Germany's Metz.

The isolated fortress is abandoned except in one particular case, *i.e.*, the barrier fort. This is a work usually placed in a particular position to bar a particular route and is specially treated both in regards infantry defence and protection to guns.

Sir G. Clarke's Redoubt.—According to Sir G. Clarke the new type of permanent fortification redoubt will be something of the nature shown in *Plate* II., and it is probable that it is the sort of work we shall find on the Continent, namely:—Works which cannot be taken except by regular siege operations and assault.

I hope I have made it tolerably clear that if we are employed on the Continent, siege operations either in attack or defence will fall to the lot of the British troops, but I may not have explained why

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such operations cannot be done by the R.E. alone. History will tell us clearly they cannot, but a few details of the corps R.E. on this subject may be interesting.

Among the many units which the corps R.E. is composed there are 30 fortress companies, but of these six are entirely coast defence electric light, and of the remainder only 13 are at home; two only are allocated to siege works. The strength of each company varies with its station, but if mobilized for European war it is reasonable to suppose they would be about 160 all ranks. If they were all available to go to the front at once we would have a force of about 300 Sappers, with the field companies of the army in addition. Now at Port Arthur the Japs made 17 miles of approaches and parallels and 640 yards of mine galleries, and it is easy to realize how slow the progress must have been. In the construction of these works they lost 2,000 infantry and 1,000 Sappers, a very large proportion of what we have assumed as available, and they only attacked over 2 miles of front.

In the Crimea out of a total of 1,000 N.C.O.'s and men who went out, one-third were killed, wounded or invalided; 122 killed and wounded before Sebastopol. The strength of the Sappers at any one time there was about 500 men.

These two records show that in anything like operations of the first magnitude, such as a European war, the R.E. available will not go very far, and we must remember that it is not only in siege works and active operations they are required.

It is more than likely that half of the men I have assumed as available for Siege Operations will be required for the less exciting, but none the less important work on the Lines of Communication or in camp.

It is easy to imagine that, when a large army is occupied in the sedentary occupation of besieging, there is lots of time for officers of all ranks and branches to look round and consider what work is necessary for the efficient running of their respective jobs. Thus the P.M.O. will require permanent hospital buildings and all the accessory buildings connected with it, with drainage and water supply and light laid on. The P.V.O. will want something in the same nature but less elaborate. The headquarters will want offices. The A.O.D. and A.S.C. will require stores built, and after they are all supplied the Chief Engineer might ask for a complete set of shops and stores and tool depôts.

Another work which will certainly develop is the construction of Siege Railways. These, as you know, are required to supply ammunition to the siege batteries every day along a light line. The construction of this line may well entail engineering problems of a high order and very heavy work.

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Besides railways there are roads throughout the camp which we all know are absolutely necessary as soon as an army sits down. Who do you expect to do all this work? There are only two probable sources of supply of labour, and one improbable—the troops and the inhabitants, and our allies! Are the inhabitants likely to wish to take our 5s. a day for work directly connected with the starvation of their brothers? The troops alone will be available. For all the technical and trade work there is no one available but the R.E. We must have tradesmen. Every R.E. officer, N.C.O. and sapper must at any moment be prepared to turn his sword or rifle into a measuring rod, and to revert from soldiering to engineering and back again as necessity arises. We are now enlisting a class of recruit termed a "pioneer." He is usually a tradesman's assistant, but not a tradesman. Will these men be useful in such an operation as I have sketched? I think not. With our limited numbers we require every man to be a tradesman.

The R.E. are therefore required as much "behind the battle" as in front. As the numbers available won't go round we must have help from the rest of the Army. This help may take the following shape:—Horses from the cavalry; horses and explosives from the artillery; large working parties from the infantry. Will you be prepared to do this?

Co-operation of all arms is absolutely necessary in siege operations; and that army will do best which first recognizes that, like the forts and redoubts it is attacking, its various branches require mutual support, whether it be in camp, parallel, sap, mine, or assault.

BOOKS CONSULTED.

Fortification, Clarke; *Growth of Offensive in Fortifications*, Matheson; *Fortifications Cuirassée*, Piarron de Mondesir; etc., etc.

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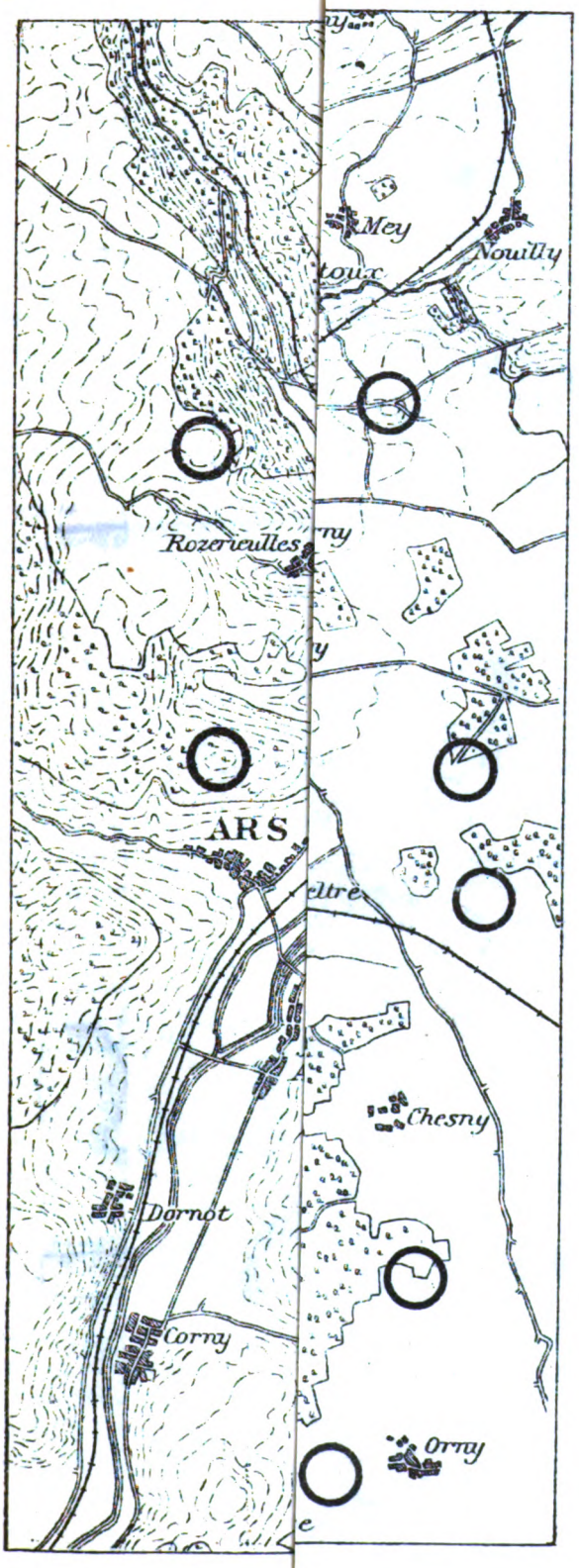
PLATE I.



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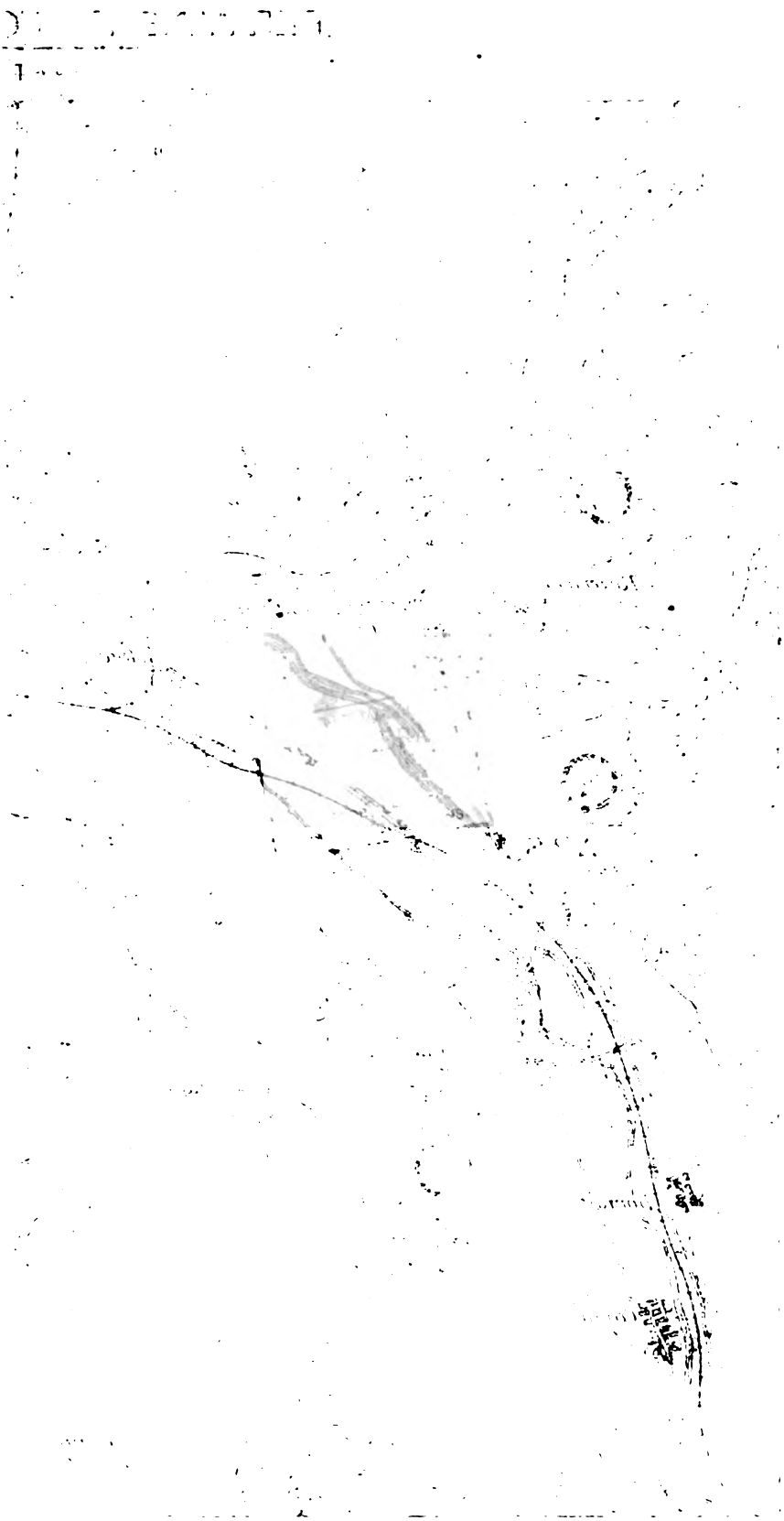

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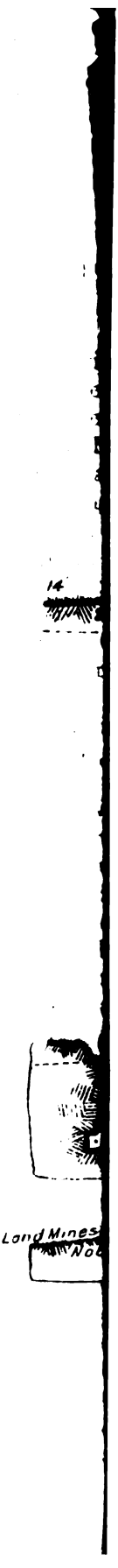
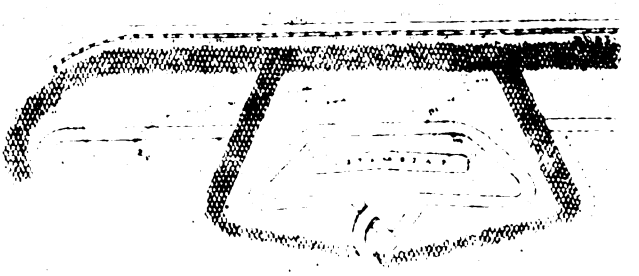


ASTOR, LENOX
TILDEN FOUNDATIONS.



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A SIMPLE METHOD OF PILE DRIVING.

By LIEUT. G. LE Q. MARTEL, R.E.

THE following short description of a somewhat novel method of pile driving, used by the 9th (Field) Company in the construction of a light bridge in the Repository at Woolwich, may be of interest.

The method used was to slide the monkey up the pile itself, and to drop it on a chock clamped near the foot of the pile by grip straps; thus making each pile serve as its own pile driver. The piles were 6-in. × 6-in. timber and 20 ft. long. The monkey, A, was also a piece 6-in. × 6-in. deal with a cross-piece at the top to take the weight which was 1 cwt. Straps of 2-in. × ¼-in. iron passed round the pile and were bolted to the monkey to guide it up and down the pile. The chock, C, was made of 6-in. × 6-in. deal, and 3 ft. 4 in. long; two notches were cut to take the grip straps as shown in the figure. The grip straps were made of 2½-in. × ¼-in. iron, and the shoes of ⅛-in. plate. An iron bracket, B, fitted over the pile, and served to support, on one side, a snatch block for raising the monkey, and on the other, a steel wire which passed round the bolt of the lower grip strap. The steel wire was not used at first but was found to be an improvement in that it prevented any slipping of the grip straps, which occasionally happened when the piles were wet. Iron bands were fitted to the bottom of the monkey and the top of the chock.

The procedure was as follows:—The monkey (without its weight) was slipped on the pile, and the bracket B, the block, and the fall put in place. Three guys were then fixed to the top of the pile, and it was raised vertical and put in its place. The chock C was next fixed a sufficient distance above the mud or water, so that it would not be submerged when the pile was driven home. The weight was then fixed on to the monkey and the pile driving commenced. The total weight of the monkey was 140 lbs. and the drop 4 ft.; the piles were driven between 5 ft. and 8 ft. down. In one or two cases when the pile started moving sideways, it was found possible to correct its position, by leaning the pile over with the guys, driving a short distance, and then straightening it again; this of course could only be done when the pile had not been driven very far in. Sixteen piles altogether were driven and no difficulty was experienced. The average time taken erecting, driving and sawing the pile off to the right height was two hours, and seven men were required.

The disadvantage of this method is that, unless the piles are required to finish some distance above the surface of the mud or water, they must be bought longer than is required. On the other

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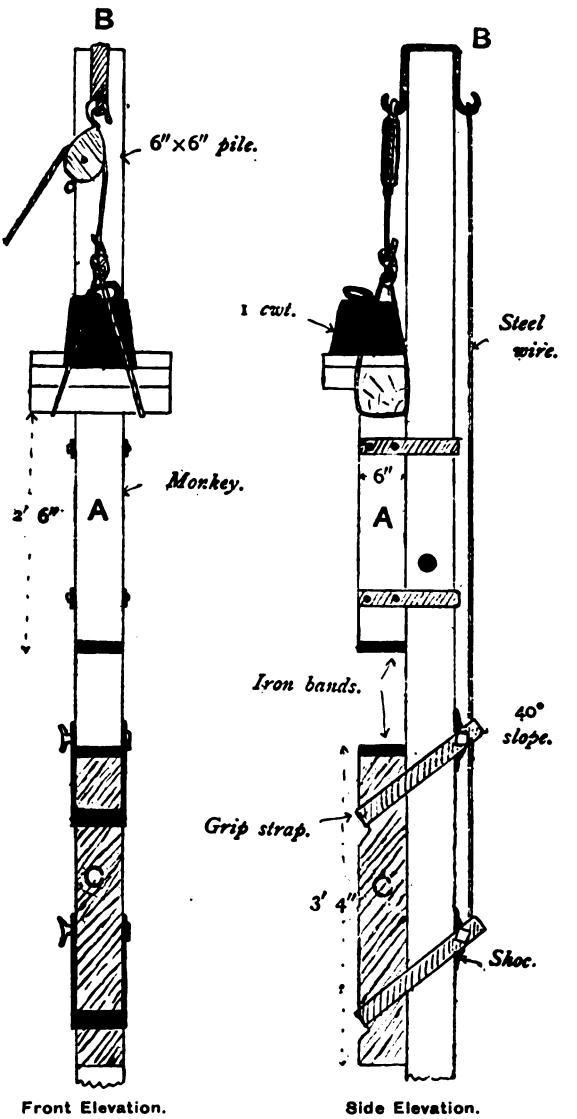
hand the top part of the pile is not in any way damaged, and can be used for other purposes when it has been sawn off.



Scale—1 *ft.* = ½ *in.*

The advantages are :—

(1). No temporary trestles are required for the support of a pile driver.
(2). No brushing of the ends of the piles.
(3). It takes very little time to set up the pile driver.
(4). The piles are easily guided straight.
(5). The parts of the pile driver are simple to make.

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

(*Continued*).

By MAJOR H. BIDDULPH, R.E.

The utter rashness of the Afghan War was demonstrated still more plainly in the years immediately following, for the British were involved in hostilities with the powerful states of Scinde, Gwalior, and the Punjab in rapid succession; and it was through these territories that the lines of communication of the army in Afghanistan ran.

SCINDE CAMPAIGN, 1843.

The relations of the British with the Amirs of Scinde had not been very happy since the opening of the Afghan War in 1839; and the unsatisfactory state of affairs culminated in a treacherous attack on the British Residency at Hyderabad on 15th February, 1843. The escort of the Resident (Major James Outram) consisted of the light company of H.M. 22nd Foot, and in the river there were lying close by the two small steamers *Planet* and *Satellite*, and a flat. Outram withdrew his men on to these vessels without much difficulty, and joined Sir C. J. Napier who was on the alert at Halla 35 miles north-west of Hyderabad, and was already marching to attack the enemy.

On the 17th February he came into contact with them on the banks of the Fulaili Nullah at Meeanee, 6 miles from Hyderabad, and after a desperate fight against a foe five times as numerous as his own force, defeated them with immense slaughter. His small force did not permit of much tactics; he advanced in echelon across the flat ground, and as the troops closed on the enemy, the Baluchis made successive charges at close quarters, but were slowly driven from the field with the loss of all their guns, etc. Hyderabad was entered on the 20th February and Scinde annexed on 12th March; but one Sirdar, Mir Sher Mohammed, still remained in the field with 20,000 men at Dubba, some 4 miles from Hyderabad.

Having been reinforced Napier marched to the attack, and found the Baluchis (as before) posted behind a nullah.

A preliminary shelling from the artillery, followed by an advance of the infantry, compelled the enemy to give ground; and the turning of both flanks by the cavalry turned the retreat into an utter rout.

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Troops engaged at Meeanee, 17th February, 1843.

9th Bengal Light Cavalry.
Scinde Irregular Horse.
Poona Irregular Horse* (detachment).
2-2nd Battn. Bombay Artillery.
3rd Company Golundaz, Bombay Artillery.
Madras Sappers and Miners (half C Company).
H.M. 22nd Foot.
1st Bombay Grenadiers.
12th and 25th* Bombay N.I.

Casualties :— 6 officers and 56 other ranks killed.
13 ,, 181 ,, ,, wounded.

Troops engaged at Hyderabad, 24th March, 1843.

The corps at Meeanee, as above.
1st Troop Bombay Horse Artillery.†
2-1st Battn. Bombay Artillery.
Remainder of C Company Madras Sappers.†
3rd Bombay Light Cavalry.†
8th and 21st Bombay N.I.

Casualties :— 2 officers and 37 other ranks killed.
10 ,, 221 ,, ,, wounded.

Garrison of Entrenched Camp at Dubba, 24th March, 1843.

Detachment 6th Bombay N.I.
15th Bombay N.I.
Details from corps in the field.

At the attack on the Residency, 15th February, 1843, the Resident's escort (viz. the Light Company of H.M. 22nd Foot) and a naval force of some 110 men were engaged, on H.C.V. *Planet, Satellite* and a flat.

The casualties were insignificant, but the naval detachment received the Meeanee medal for the affair, although none of them were present at the battle two days later.

In the same way the crews of the H.C.V. *Comet, Meteor* and *Nimrod* (115 men in all) received the medal for Hyderabad, although stationed in the Indus, off Dubba, several miles away.

It is extremely doubtful if the 15th Bombay N.I. and those details from the 6th Bombay N.I. and other corps which garrisoned the

* Recently with England in Afghanistan.
† Recently with Nott in Afghanistan.

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entrenched camp at Dubba, received the medal, although actually nearer the field of battle than the Indus Flotilla.

The total number of Meeanee medals struck is much greater than is usually supposed, being as under :—

H.M. 22nd Foot	65
Artillery	63
Sappers	14
9th Bengal Cavalry	?*
Scinde Irregular Horse	90
Poona Irregular Horse	14
1st Bombay Grenadiers	148
12th Bombay N.I.	153
25th Bombay N.I.	206
Miscellaneous	8
Indus Flotilla (Naval)	110

Here again the comparative rarity of the medal must be gauged by the number of European recipients, which (including officers) was some 120, of whom 40 were naval.

The European Naval medals for Hyderabad numbered 60.

All the *Naval* medals for this campaign seem to have been issued with the " China, 1842," suspender, and were impressed.

The medals issued to the Company's troops (European and Native) were indented on the rim, as a rule (apparently in India) ; while those of the 22nd Foot have block engraving.

Scinde, 1843.

Three medals, 1·4-in. diameter, silver.

Obverse.—Crowned head of Queen Victoria.
Legend " Victoria Regina."

Reverse.—(*a*). " MEEANEE 1843 " within a wreath, surmounted by a crown.
(*b*). " HYDERABAD 1843 " within a wreath, surmounted by a crown.
(*c*). " MEEANEE HYDERABAD 1843 " within a wreath, surmounted by a crown.

Mounting.—Steel bar and clip for non-commissioned ranks; silver ditto for officers.

Ribbon.—Military ribbon of India, 1¾ in. wide.

N.B.—The steel bars and clips of the medals issued to the 22nd Foot were replaced by silver ones, by Colonel Pennefather ; and this was also done very generally by other corps, European and Native.

* Returns not available (say 90).

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Engineer Officers employed in the Campaign.

M.H. *Lieut. E. J. Brown, Ben. Engrs., Secretary to the Resident.
M.H. Capt. R. Henderson, Mad. Engrs. } C Company, Madras
M.H. Lieut. A. J. M. Boileau, Mad. Engrs. } Sappers & Miners.
M.H. Major C. Waddington, Bo. Engrs.
H. Lieut. T. Studdert, Bo. Engrs.
— Lieut. C. A. Orr, Mad. Engrs. (did not receive a medal).

M. signifies present at the Battle of Meeanee.
H. signifies present at the Battle of Hyderabad.

GWALIOR, 1843.

This campaign was occasioned by the disturbances which followed on the death of the Maharajah. To overawe the disputants the Governor-General (Lord Ellenborough) mobilized at Agra and Jhansi an "Army of Exercise" under Sir H. Gough, the Commander-in-Chief.

The peace manœuvres however changed so rapidly to operations of war that the Governor-General, and four ladies who had come to look on, came under fire from the Mahratta guns.

The two wings of the "Army of Gwalior" fought battles independently of each other at Maharajpore and Punniar respectively on the same day, 29th December, 1843.

The British losses at Maharajpore were very heavy, as the infantry made a frontal attack on an entrenched position held by an enemy with a powerful artillery.

At Punniar matters were managed better. An attack by the British on the centre and left of the Mahratta position was completely successful at slight cost.

For both these battles bronze stars with silver insets were given, and Lord Ellenborough gave the four ladies present at Maharajpore gold and enamel stars of a special pattern, bearing the Queen's head.

For the succeeding operations in 1844, in the southern Mahratta country, no medal was given, nor for the operations on the Scinde Frontier which were of a most arduous nature, and which lasted till 1845.

Gwalior, 1843.

Two medals. A six-pointed bronze star, with silver inset.

Reverse.—Quite plain.

Obverse.—(*a*). "MAHARAJPOOR 29th Decr 1843."
(*b*). "PUNNIAR 29th Decr 1843."

Mounting.—A bronze hook at the back.

N.B.—The stars were made from the captured guns. Later on most recipients added mountings of varied designs, and wore the medal with the "Military Ribbon of India."

The medals as originally designed had a silver elephant in the centre; but, on account of the expense of manufacture, a star was

* Present also at attack on Residency, 15th February, 1843.

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substituted ; and it is believed that Lord Gough was the only soldier to receive and wear the bronze star of the original design.

As in the case of the 1st Afghan War, no medal rolls for this campaign are available either in India or England, but in the case of the Queen's troops it is possible to verify their medals in most instances from other official documents, and sometimes those of Europeans in the H.E.I.C.S. The engraving on the backs of the stars is very typical and shows readily whether a medal is worth paying attention to.

Troops present at Maharajpore, 29th December, 1843.

Right Wing, Army of Gwalior, Lieut.-General Sir H. Gough, C.-in-C.
Cavalry :—Major-General Sir J. Thackwell.
3rd Brigade :—Brigadier C. R. Cureton, 16th Lancers.
H.M. 16th Lancers.
1st Bengal Light Cavalry.
4th Irregular Cavalry (in reserve).
4th Brigade :—Brigadier J. Scott, 9th Lancers.
The Governor-General's Bodyguard.
4th and 10th Bengal Light Cavalry.
2nd Infantry Division :—Brigadier J. Dennis, 3rd Foot.
3rd Brigade :—Brigadier T. Valiant, 40th Foot.
H.M. 40th Foot.
2nd and 16th Bengal N.I.
4th Brigade :—Brigadier L. R. Stacy, 43rd B.N.I.
14th, 31st, and 43rd Bengal N.I.
3rd Infantry Division :—Major-General J. H. Littler.
5th Brigade :—Brigadier T. Wright, 39th Foot.
H.M. 39th Foot.
56th Bengal N.I.*
6th Brigade (in reserve) :—Brigadier S. D. Riley, 62nd B.N.I.
62nd and 70th Bengal N.I. (not engaged).
Khelat-i-Ghilzie Regiment (only flank companies engaged).

Detachments of the 5th and 8th Bengal L. Cavalry, and one company 39th B.N.I. were also present, probably as escorts.

Artillery :—Brigadier G. E. Gowan.
Bengal Horse Artillery :—2nd and 3rd Troops, 2nd Brigade.
2nd Troop, 3rd Brigade.
Bengal Foot Artillery :—1st Company 1st Battalion.
1st Company 4th Battalion.
2nd, 3rd, 4th Companies 4th Battalion (in reserve), also Native Reserve of 5th, 8th, 9th and 10th Companies 6th Battalion.
Engineers :—Major E. J. Smith.
3rd, 4th, 7th Companies Bengal Sappers and Miners.

* The 3rd Battalion of this brigade, viz., the 35th B.N.I., was left at Agra.

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Casualties :— 5 British officers and 101 other ranks killed.
34 ,, ,, 654 ,, wounded.
56 guns were captured. Among the killed was Major-General C. H. Churchill, C.B., Q.M.G., Queen's Troops, a Waterloo veteran.

Troops present at Punniar, 29th December, 1843.

Left Wing, Army of Gwalior, Major-General J. Grey in command.
1st Cavalry Brigade :—Brigadier A. Campbell, 9th Lancers.
2 squadrons H.M. 9th Lancers.
5th and 11th Bengal L. Cavalry (2 squadrons each).
2nd Cavalry Brigade :—Brigadier D. Harriott, 8th L. Cavalry.
8th Bengal L. Cavalry.
8th Irregular Cavalry.
Cavalry, Bundelkhand Legion.
1st Infantry Brigade :—Brigadier W. A. Yates, 51st B.N.I.
H. M. 3rd Buffs.
39th and 51st Bengal N.I.
Bundelkhand Legion.
2nd Infantry Brigade :—Brigadier R. Blackall, 50th B.N.I.
H.M. 50th Foot.
50th and 58th Bengal N.I.
Artillery :—Brigadier E. Biddulph.
Bengal Horse Artillery :—1st and 3rd Troops, 3rd Brigade.
Bengal Foot Artillery :—6th Company 6th Battalion.
Engineers :—
1st Company Bengal Sappers and Miners.
Sipri Contingent :—Brigadier O. Stubbs, 24th B.N.I.
Casualties :—2 British officers and 35 other ranks killed.
7 ,, ,, 175 ,, wounded.
24 guns were captured.

Officers of the Bengal Engineers present at Maharajpore.

Major E. J. Smith, Chief Engineer.
,, E. Sanders, Deputy Secretary to Government of India, Military Department (killed).
Capt. H. M. Durand, Private Secretary to Governor-General.
Lieut. W. Abercrombie, Brigade-Major.
,, T. Renny-Tailyour, Quartermaster.
,, C. B. Young.
,, S. Pott.
,, D. Campbell.
,, W. D. A. R. Shortt.
,, J. E. T. Nicolls.

Officer of Bengal Engineers present at Punniar.

Lieut. J. H. Maxwell.

N.B.—This list is perhaps incomplete.

(*To be continued*).

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EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

SCINDE. 1843.

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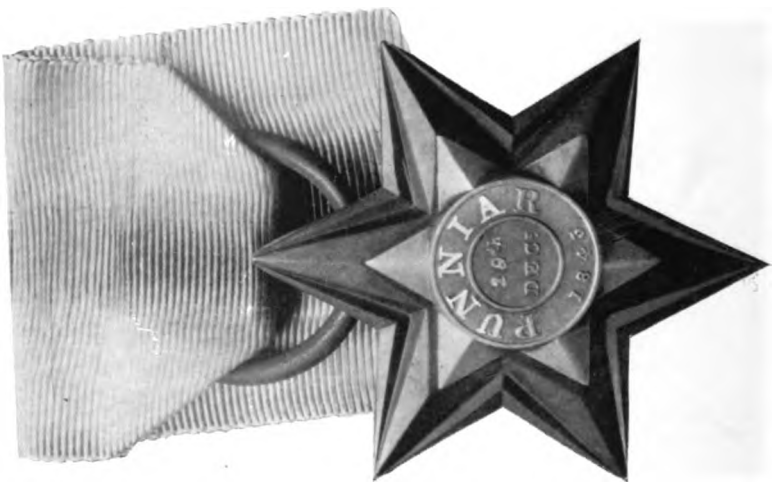
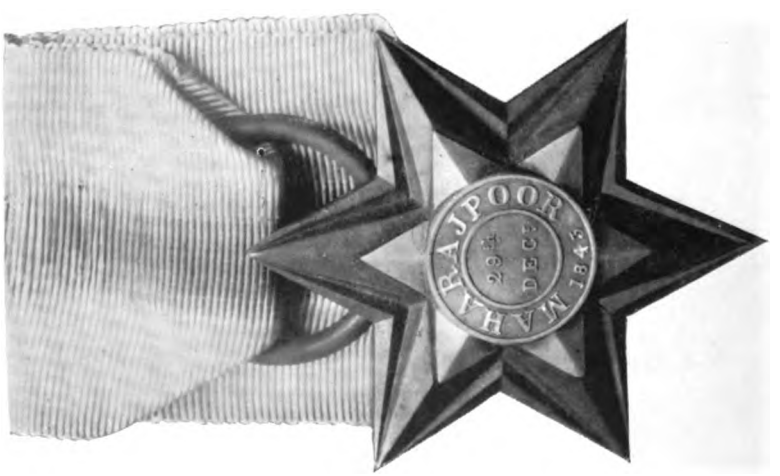
EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.



GWALIOR. 1843.



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Lieut.-Colonel Sir George Archibald Leach, K.C.B., R.E.

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MEMOIR.

LIEUT.-COLONEL SIR GEORGE ARCHIBALD LEACH, K.C.B.

By the death of Lieut.-Colonel Sir George Archibald Leach, K.C.B., on the 18th of June last, the Corps has lost its oldest member, and one who, though he retired from the Active List as long ago as 1861, on receiving an appointment in the Inclosure Tithe and Copyhold Commission, always took the keenest interest in matters connected with the Corps and especially its charitable institutions, in the management of which his residence in London since 1880 enabled him to take an active part. He died on the anniversary of the Battle of Waterloo which occurred only five years before his birth, and although he had entered his 94th year he was at the time of his death in almost complete possession of all his faculties, and able to take an interest in current affairs and enjoy the society of his numerous friends. The following sketch of his career may therefore be of interest to members of the Corps.

Covering as it does nearly 80 years of active life it is difficult to do more within the limits of one of these articles than briefly outline the principal incidents of his life. Much of his work for the Corps of comparatively recent years will have been recorded in the pages of the *R.E. Journal* and will be within the memory of most of the members of the Corps, so that it is proposed to dwell more upon such of his work as from lapse of years may not be so well known now, and upon a few details of his private life which will tend to illustrate his character.

Born on the 25th of April, 1820, he was the fifth son of Mr. Thomas Leach, Deputy Keeper of the Records, under his brother, Sir John Leach, the first Vice-Chancellor of England, and subsequently Master of the Rolls. In his early boyhood he had a strong wish to enter the Navy, but this was not approved by his parents and he entered the Royal Military Academy at 14, passing high, and obtained his commission in the Royal Engineers as Second Lieutenant on the 14th December, 1837, just after he was 17. In his batch there were several who became prominent members of the Corps, of whom the most distinguished was Field Marshal Sir Lintorn Simmons, who was just above him and with whom he always maintained a close friendship. Sir Lintorn only a month before his death in 1903 wrote to him as "his oldest living friend," after he had paid what proved to be a farewell visit at Blackwater. One only of the batch now

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survives, Colonel H. B. O. Savile, R.A., whose acquaintance Sir George had recently renewed and who is still active and vigorous at Clifton and was able to act as A.D.C. to Lord Roberts when he inspected the Clifton College Corps in 1910.

After the receipt of his Commission and the completion of his course at, what is now, the School of Military Engineering at Chatham, Lieut. Leach was, in accordance with his wishes, posted to the Ordnance Survey under Colonel Colby, and in May, 1839, reported himself to Capt. Tucker at the Survey Office in the Foundling Hospital at Dublin. He received his Commission as First Lieutenant in December of the same year. In 1841 he came to England in charge of the trigonometrical branch to erect and fix the trigonometrical stations for detail survey of the six northern counties, which was ordered to be commenced on the completion of the Irish Survey, then rapidly drawing to a close. In 1843 he returned to Ireland and was engaged in introducing and carrying out the method of representing ground on plans by the system of contour lines, now generally adopted on all the national surveys of the world as the only method by which the form of the ground can be delineated on maps with mathematical accuracy. He was also engaged in the revision of the maps of the northern counties of Ireland which, being the first done, were much less perfect than those of the southern counties.

Although he had naturally a good deal of travelling, his head-quarters were at Londonderry, and he soon made his influence felt in the promotion of various local improvements. Old friends have often pointed to the clock on the Town Hall as one of his earliest efforts to supply a want in the city. He also had a great deal to do with the arrangements for a show of the Royal Agricultural Society of Ireland at Londonderry in 1847, and received a handsome silver claret jug from the committee in recognition of his services.

Like many other members of the Corps he married young, and in 1844 he married the eldest daughter of Mr. Edward Leigh Pemberton, a prosperous London solicitor who eventually succeeded his brother Lord Kingsdown at Torry Hill in Kent.

In his wife, who when quite a girl had been obliged to take the management of her father's household and large family, he had a real helpmeet. With comparatively small means and a rapidly increasing family of sons, they commenced at an early period the system of self-denial and spending very little upon themselves which was a marked characteristic of both their lives. Expenditure for the benefit of the sons was a different matter.

At Londonderry they made several close and intimate friendships which they kept up during their lives. Living at first in the city itself, they subsequently moved into a large house, which was in Chancery and which the owners were only too glad to have occupied at a

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nominal rent. The grounds extended to the river Foyle and the proximity to the river enabled Capt. Leach, as he then was, to take up again the amusement of sailing which he had commenced at Chatham and which subsequently became his principal recreation. He had a small boat built which, to the delight and astonishment of his man, he showed to be unsinkable, and was able to pass many pleasant summer evenings on the river.

While at Londonderry he was employed by the Office of Woods and Forests to hold various local enquiries in connexion with Town Improvements Bills which were numerous at that period.

Between 1846 and 1849 the failure of the potato crops in Ireland produced widespread distress and famine; and relief works were undertaken under the supervision of strong local committees appointed by the lieutenants of counties at the instance of the Public Works Commissioners in Ireland, with whom the expenditure of the large sums authorized by Parliament rested. To ensure that the works undertaken would be of public utility and in districts where relief was required, various officers were appointed to report upon the proposals submitted by the local committees in the various counties, to endeavour to obtain contributions from landowners whose estates would be benefited, and generally to furnish information as to the state of destitution in the locality and the necessity for providing employment for the labouring poor. A special feature of the relief works was that the workmen employed were to be paid in food for themselves and their families.

During these years Lieut. Leach was actively employed on this service, and from the records which he kept it is evident that the work of deciding upon the merits of the numerous and often unreasonable applications made to the Commissioners was no easy task. He was employed principally in the south of Ireland, and he obtained credit for the way in which he discharged his duties.

In 1847 he received his promotion as Captain.

In 1849 he received a visit from Lord Macaulay, who had come to gather material on the spot for the account in his *History of the Siege of Derry*. In a letter which appears in *Lord Macaulay's Life* he refers to his introduction to Capt. Leach, "a sensible, amiable young officer so far as I could judge," and gives an amusing account of a visit to Boom Hall opposite the position of the celebrated boom, and his scepticism as to the origin given by his hostess of an iron ring fixed in a rock there, when he observed a similar one not far off. "I did not tell the good lady what I thought, but as soon as we had taken our leave I told Leach that these rings were evidently put there for the same purpose, that of securing shipping. He quite agreed with me and seemed to admire my sagacious incredulity a great deal more than it deserved."

Capt. Leach was moved to Belfast in 1853, but remained there

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only for about nine months; long enough, however, to cement his friendship with Mr. John Mulholland, a keen yachtsman, afterwards M.P. for Downpatrick and the first Lord Dunleath. He was then the owner of a yacht called the *Heroine*, but in 1865 built the celebrated schooner *Egeria* on which Colonel Leach, as he had then become, was a regular visitor whenever he could get away from his official duties, and with which his name was in consequence much identified. She was very successful, but her owner and Colonel Leach were never satisfied that some improvements could not be made; and after a season's racing the winter was much occupied in planning alterations and improvements. She was the first vessel to adopt the now universal topmast spinnaker, and Colonel Leach used often to describe the delight of the crew when it went up for the first time.

In the autumn of 1854 he was appointed head of the Irish Survey in Dublin, and moved to the delightful residence in the Phoenix Park at Mountjoy Barracks where the Survey work was done by about 20 Sappers and 100 civilians. He remained in Dublin for about six years enjoying the intimate friendship of Colonel Larcom, R.E., who was then Under Secretary for Ireland, and many other leading men in Dublin. He was employed a good deal in connection with surveys and the supply of maps for the Irish Encumbered Estates Court, and there first interested himself in the question of registration of title in connection with the sale of land.

While he was in Dublin the question of decorating the Wellington Memorial with bronze bas-reliefs commemorative of Wellington's victories was taken up, and three sides of the monument were done by eminent sculptors. The funds however were not sufficient to provide the fourth, and, at the suggestion of Sir Thomas Larcom, he was asked by Lord Carlisle—then Lord Lieutenant—whether he and his draughtsmen could furnish a design of a simpler and less expensive character. This was accomplished with marked success, and they received much credit for the work. The design now occupies the fourth side of the base of the column.

He took great interest in the Zoological Gardens there, and used frequently to attend the Saturday breakfasts of the committee at the gardens. He was also able to enjoy his favourite recreation of yachting with members of the two Kingstown clubs. The Royal Alfred Yacht Club was one of the first, if not the first, to establish Corinthian races where the crew was composed entirely of amateurs, and in these he frequently took part. With his old Derry friend, Mr. James Acheson Lyle, and others he began to discuss the possibility of a central association for yachting which should occupy the position of the M.C.C. at cricket and enable one code of rules to be framed instead of each club round the coast racing under its own rules.

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His family was now growing up. The three eldest boys had been sent to Highgate School where one of his brothers was a master, and it had been intended that the two elder should try for the foundation at Eton, for which their headmaster considered that they would have a good chance. A curious difficulty however arose at the last moment. The Statutes required candidates to be of English birth and both had been born in Ireland. They were therefore not eligible; but that the exigencies of the Service should produce such an effect was seen to be absurd, and an amendment of the Statutes was shortly after carried into effect.

The work which he had been able to do for the Landed Estates Court, and especially a report which he made as to improvements which might be effected in the system of registry of deeds and the work of the office, was regarded as of such importance that when he became Lieut.-Colonel in 1860 strong representations were made by the judges that it would be greatly to the public interest if he were allowed to remain in his position as head of the Irish Survey; and at their instance the matter was referred to the Duke of Cambridge as Commander-in-Chief by the Lord Lieutenant. The Duke, however, refused the application, partly on the ground that Colonel Leach's whole military service had been at home, and he was faced with the probability that he would have to go abroad, and in all likelihood as C.R.E. to Hong Kong.

This, with seven sons of whom the eldest was then fifteen, would have been a serious matter, as those of them who were at school would necessarily have remained at home without his aid and guidance; and it was for his family one of the most fortunate events in his life that by the death of Colonel Dawson, R.E., a vacancy for an Engineer officer occurred in the office of the Inclosure Tithe and Copyhold Commissioners. He applied for and obtained the appointment and retired from the Army, commuting his half-pay for a cash payment under a then recent regulation. He was thus enabled to remain at home and direct and superintend the education of his children and the choice of their careers. He took up his residence at Highgate, and all his seven sons were educated at the school there. The holidays he devoted to the instruction of the schoolboys in sailing, swimming, etc., frequently at Ryde, where one of his brothers was living, while his wife used generally to take the younger ones to her father's place in Kent.

At the Inclosure Office he soon made his influence felt. After the passing of Lord Westbury's Land Transfer Act, he rendered valuable assistance to the Land Registry Office in superintending the Survey and examination on the ground of properties which were registered and the preparation of the necessary maps. Shortly before his appointment, Mr. James Caird, an eminent agriculturalist and formerly M.P. for Stirling, had been appointed one of the

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Commissioners, and with him Colonel Leach formed a warm friendship which continued until the death of Sir James Caird, K.C.B., as he afterwards became, in 1892.

In January, 1878, Colonel Leach was appointed one of the Commissioners, joining Mr. George Ridley and Mr. Caird; and under their auspices with Lord Lyttelton, now Earl Cobham, who was appointed on the resignation of Mr. Ridley in 1880, the office acquired a well-deserved reputation not only for the work done by them in the administration of the numerous Acts of Parliament with which they had to deal, but for the assistance and advice which was always readily given to any one who had occasion to apply there. The importance of the Commission gradually increased as new duties were thrown upon them. Their title was changed in 1882 to that of the Land Commissioners for England on the passing of the Settled Land Act of that year, and eventually in 1891 the Commission was merged in the newly formed Board of Agriculture. The period had now arrived for Colonel Leach's retirement, but he was specially requested to remain to organize the new office as its first Secretary, with Mr. Henry Chaplin, M.P., as President. After serving for nearly a year under Mr. Chaplin he finally retired on the 31st December, 1891, though he continued to go to the office for some little time afterwards, to assist his successor who is now well known as Sir Thomas Elliott, K.C.B., and who only retired last year.

Almost immediately after his retirement he had the only serious illness in his life. He and his friend Sir James Caird, who retired at the same time, both had severe attacks of the then prevalent Russian influenza and the latter succumbed.

In the Birthday Honour List of 1892 Colonel Leach's name appeared, and he received the honour of a Civil K.C.B. He had been made C.B. in 1889.

During the thirty years that Sir George Leach was at the Land Office he had taken an active part in many matters outside his official work.

On his connection with the two Engineer Charitable Societies, and the part he took in their management, it is hardly necessary to dilate as they are well known to officers of the Corps, but the Deed of Settlement of the R.E. Widows' Fund was largely due to his exertions. He also interested himself in the incorporation under the Companies Acts of the R.E. Institute.

While at Highgate he became Churchwarden of the Parish Church, and a Governor of Highgate School, becoming Treasurer and Chairman in 1888. As the school was possessed of valuable property both at Highgate and in the City of London there was ample scope for his business capacity. He retained the chairmanship until 1908.

In 1875 the efforts of himself and his friends were crowned with success by the establishment of the Yacht Racing Association, to

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the Council of which he was elected as Hon. Treasurer, and held the office till 1887, subsequently becoming Chairman. The Association soon turned its attention to the framing of rules for the measurement of the tonnage of yachts, classifying them for racing and drafting a scale of time allowance so that yachts of various tonnages might compete together upon an equitable basis. The yachting editor of *The Field* and present Secretary of the Yacht Racing Association, in an obituary notice, has stated that the mathematical and scientific knowledge possessed by Sir George Leach proved of the greatest service to his colleagues on the Council in the construction of the tonnage rule and time scale in the years 1880 and 1881.

For a time the Royal Yacht Squadron continued to sail under its own rules, but after a few years adopted those of the Association, and when the Prince of Wales (afterwards King Edward VII.) became Commodore he became also President of the Yacht Racing Association. In that office he was succeeded, when he became King, by his present Majesty, who held it until he ascended the throne on the death of King Edward. Upon his resignation in 1910 Sir George Leach was unanimously elected to the office, an honour which he accepted with diffidence, but highly appreciated. On all the difficult questions which arose as to rules of rating and measurement of racing yachts he had been a frequent contributor to the columns of *The Field* and also on the one-sided conditions imposed with reference to the America Cup. He had contributed a chapter on schooner racing to the Badminton volume on yachting, and though never a yacht owner himself was through his association with Lord Dunleath and the *Egeria* a recognized authority on yacht racing. After serving for a good many years on the Sailing Committee of the Royal Thames Yacht Club, he filled at his death the office of cup bearer ranking after the three commodores.

In 1881 he had been asked to join the Board of the newly formed Taltal Railway Company, a nitrate railway in Chili, on which he served for over 28 years and for thirteen as chairman. After a good many anxious years he had the satisfaction of seeing it established on a firm financial basis and enjoying exceptional prosperity which it still continues.

His work with the Incumbered Estates Court in Ireland, and his connexion with the Land Registry Office in England led him seriously to consider the question of simplifying and cheapening the transfer of land in England, which, owing to the numerous interests arising out of the English system of land settlement, presents much greater difficulties than can arise in any other country. He gave valuable evidence before the Royal Commission on the subject and published a pamphlet setting out his views in 1878. Many points of his scheme have been adopted in the Land Registry Office.

At the election of 1865, when Lord George Hamilton and Mr.

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Octavius Coope contested Middlesex against Viscount Enfield and Mr. Labouchere, Colonel Leach was Chairman of the Highgate Conservative Committee and Lord George Hamilton made his first political speech at his house.

In 1880, Colonel Leach left Highgate which had always been difficult of access from St. James' Square and moved to 6, Wetherby Gardens, South Kensington, where he resided till his death.

In 1889 his only daughter married Mr. Joseph Savory, then an Alderman of the City of London, who became Lord Mayor in 1891 and was most ably supported by his wife in the social duties of the office.

With the exception of a visit to Switzerland in 1869 Sir George had rarely left England. He had however been unable to refuse in 1885 an invitation from his friend and connection, Sir John Bateman Champain, R.E., to go out with him in a telegraph ship as far as Kurrachi, whence a line was to be laid in the Persian Gulf, and he was thus able to pay a visit to one of his sons at Roorkee and see other places in India and Egypt on his way home.

His retirement from official life gave him the increased leisure to travel which he had always looked forward to.

In 1893 he paid a visit to his son Edward, then C.R.E. at Halifax, N.S., going on to an old Derry friend, Mr. Robert Orr, who had become President of the Chamber of Commerce at New York, and attended the races for the America Cup which resulted in the defeat of Lord Dunraven's cutter *Valkyrie*. He then went to Chili and made a thorough inspection of the line and works at Taltal which proved of use to him when he subsequently became chairman of the company. Always a good walker and fond of mountain climbing, he astonished the people there by his powers of endurance at 73, and returned across the Andes at a time when the non-completion of the Trans-andine Railway involved a long mule ride to connect the lines on either side of the Continent.

In 1894 he and his wife celebrated their golden wedding, and few couples can have been able to say with them that after fifty years of married life and eight children they had never had a break in the family. With sons in the Army, two of whom had seen a good deal of active service, it is even more remarkable. The first break occurred in the death of Lady Leach in 1896 after a short illness, to the great grief of her family. Quiet and unassuming, she possessed considerable strength of character, and her advice was often sought by members of her own and her husband's family, while her simple tastes and powers of management had proved invaluable to her husband in his early days. In the lovely little churchyard at Sunningdale, near their daughter's home, they now lie together.

Possessed of wonderful vitality, Sir George continued during the next ten years his hold on the numerous associations and bodies

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with which he was connected, and made various expeditions including two visits to Switzerland, and a visit to Rome and Naples. His two last were an expedition to Sicily in 1905, and to Pau and Biarritz in 1906, in both of which he was accompanied by his two Sapper sons. Always of a hospitable nature, his house was available for friends and relations; and quite to the last he seldom heard of any old friends being in town without saying "We must ask them to dine" or "We must ask them to come and stay." Although his memory somewhat failed him during the last three years, he was always unwilling to give up any control over his affairs. In those of friends and relations he never ceased to take an interest. In fact his family found that the affairs of other people interested him in his later years much more than his own.

His last appearance in public was at the Corps dinner in 1910, when his son, General Sir Edward Leach, was the senior officer on the Active List, and Sir George replied to the toast of the veterans, laying stress on the importance of such gatherings not only, as the late Duke of Cambridge used to urge, in fostering *esprit de corps* but still more in keeping alive the brotherhood of the Corps. That the son who then and up to the time of his death was full of life and vigour should have been the first to go, no one who was present could have expected; and his sudden death cast a shadow over the last few weeks of the father's life.

This record of his life has, it is hoped, shown in some measure the special features of Sir George Leach's character, among which were pre-eminent the wideness of his sympathies, his conviction of the duty of personal service and the happiness conferred by it. Idleness or want of interest in life was incomprehensible to him, and if the work was for someone else, it was all the sweeter.

As regards the working of the Corps, he was a great believer in the system which prevailed in his early days of allowing any one who showed a special aptitude for any particular branch, to remain in it and acquire real proficiency in that branch, which was exemplified in his own case by his whole military career having been devoted to the Ordnance Survey. He often referred to what used to be the proud claim of the Corps, that if a man was required for any special work he could always be found in the Royal Engineers. He often interested himself in pressing the claims of members of the Corps and others whose services he considered had not met with due recognition.

A good judge of character, his sympathetic appreciation of honest work enabled him to inspire his subordinates with a similar spirit and to give him of their best, while his colleagues on the numerous boards and committees with which he was connected could always rely on any expression of opinion being received with courteous consideration and good humour—which frequently disarmed opposition.

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His powers of work and the care with which he studied all the circumstances of any subject that was to come under discussion, gave him a great advantage on all boards and committees and enabled him as a rule to carry his points. His chairmanship of one body was not inaptly described as a benevolent dictatorship which his geniality and the confidence he inspired in his colleagues led them cheerfully to accept.

Strong in his own opinions, he was always ready to admit that others were entitled to express their own, while his practical common sense and willingness to make concessions on matters which were not essential were invaluable to him. Combining tact with firmness and with a special facility for grasping the essential points of any topic under consideration, he was able to keep discussion within reasonable bounds; and, as one of his colleagues who had been intimately associated with him for many years wrote after his death, "When unexpected difficulties arose he at once met them with such skill, patience, and good humour, that they seemed quickly to lose their force, and he soon steered the ship into smooth water again."

In all the places where he lived his influence soon made itself felt in matters connected with local requirements or improvements, and in their social life he was always a welcome and leading spirit.

A striking characteristic of his life was his singular contentment with his surroundings and grateful appreciation of any service rendered to him, however small. The successes of his sons were a source of great pride and pleasure to him, and he took almost an equal interest in any promise shown or success achieved by other members of the family, particularly in the rising generation to whom he endeared himself by many kind and sympathetic acts. His love of children continued to the last and he had many little friends who always came to him with fearlessness and confidence.

To conclude with a passage from the Masonic ritual, we may truly say of him that he nobly fulfilled the injunctions he received as a Freemason in his early days and that rising to eminence by merit he lived respected and died regretted.

G. PEMBERTON LEACH.

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TRANSCRIPTS.

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THE ENGINEERS OF THE EXPEDITIONARY FORCE.

By LIEUT.-COLONEL F. B. MAURICE, General Staff, Staff College, Camberley.

THE DEVELOPMENT OF OUR ORGANIZATION.

THE general policy upon which the re-organization of our Army, begun shortly after the South African War, has been based, may be summed up as, first, the provision of sufficient garrisons for our oversea possessions; secondly, the formation of an Expeditionary Force; and thirdly, the creation of a Second Line Army, primarily for Home Defence.

As soon as this policy had been formulated, the extent and condition of our military resources were investigated, and the functions of each part of our forces were examined with a view to creating an efficient and economical organization in time of peace which could be used with the minimum of change in war. As is well known, the broad lines of this re-organization have taken the form of divisions and brigades trained by those who are destined to lead them in the field.

The framework of this re-organization may be said to be complete in the sense that each division is composed of what is held to be the proper complement of the various arms and services, and that establishments have been worked out, both for the Expeditionary Force and for the Second Line Army. A great deal of work on matters of detail is, however, still going on. When our requirements had been determined and the existing material had been shaped to meet them, it still remained to consider whether we had obtained in every case exactly what we require in the most economical form.

If the history of the development of our military forces is recalled, it is not surprising that they should not in all cases fulfil this condition; indeed, it is astonishing that it should have been possible to create the new organization with so small a disturbance of existing formations and interests. Prior to the South African War, the Regular Army at home consisted of a reserve of military material of all kinds, from which expeditionary forces were created for each campaign as the emergency arose. The strength of this home reserve was determined much more by the requirements of our oversea garrisons, for whom reliefs had to be provided periodically, than by the conditions of any one of the military problems of the Empire. This system proved, on the whole, sufficient for our needs both during the Napoleonic Wars and the period of expansion which marked the latter half of the nineteenth century. In the

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Peninsula, Wellington was able by the exercise of cautious skill to gain the time necessary to create and train the Army with which he eventually drove the French out of Spain. In the Crimea the theatre of war was so confined as to make small demands on the manœuvring power of our Army, and our lack of organization, serious as it was, could not altogether nullify the effect of the splendid fighting qualities of the British soldier. During the period of Imperial expansion which marked the latter half of the nineteenth century we were engaged upon a long series of small wars, each fought under special conditions against an enemy with certain special characteristics. The impossibility of devising any one organization equally suitable for all of these cases made it a convenient policy to pool such of our military material as was not required for garrison duty abroad, and to form from this pool the force needed for each little campaign. Our enemies had little offensive power beyond their own borders, and in the majority of cases ample time was available to create the formations required. It was not until we were again faced by more serious military problems that the urgent necessity of having our military organization in such shape that it could be employed immediately upon the outbreak of war was everywhere appreciated.

In the meantime, a number of formations had grown up and developed which could not be placed as a whole in any modern military organization. The cavalry regiments and infantry battalions had indeed remained the fighting units for those arms, for the infantry regimental organization was purely administrative and in no way affected the war organization of the battalion. There was, therefore, little difficulty in grouping these smaller units together in formations of any desired size. But with the rest of the Army it was different. The remaining arms and services had been created in almost every case as corps, which included a certain number of military formations, but were never intended to take the field as a whole. These corps also contained a number of individuals not on the strength of any unit mentioned in war establishments. They had developed in most cases to meet the needs of the moment and not in accordance with any settled policy. Their subdivision therefore presented very considerable difficulties. All these difficulties have not yet been overcome, though most of them are in process of solution. The object of this paper is to examine this problem as it affects one of these corps which, perhaps, presents the greatest difficulties, namely, the Corps of Royal Engineers.

The question in this case is the more complicated because the numbers of the *personnel* of the Corps maintained in peace have never been based solely upon war requirements. For many years past the Royal Engineers have been the scientific pioneers of the Empire. Geographical exploration, surveys, frontier delimitation, and the construction of roads, railways and telegraphs on our frontiers have been, to a large extent, initiated and carried through by them. Further, the administration and execution of a large proportion of the public works, even of the more settled of our oversea possessions, have fallen to their lot. The result of this has been the growth of a Corps, the officers of which are altogether and the rank and file to a great extent highly-trained experts, and paid as such. Further, when the formation of field units of engineers became necessary, it was found to be extravagant to employ experts upon work

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which did not require great technical skill. Thus the periods of military training were cut down to a minimum, peace establishments were kept as low as possible, and the expert knowledge of the *personnel* was employed on work which had but a remote connection with their *rôle* in war.

With the formation of divisions the various arms have been brought much more closely into contact than was formerly the case. It is now recognized everywhere that each arm has its limitations and requires the assistance of the others to a greater or less degree to enable it to exercise its powers to the full. Co-operation in the attainment of a common end is the keynote of all higher training in the present day. Training in co-operation is carried out by bringing the arms together as much as possible, both for theoretical instruction and for practical work in the field.

Defects in Organization of our Engineers.

Now this process has brought to light certain defects in the existing organization of those Royal Engineer units which form part of the divisions. In their case such work as the maintenance of barracks, the care of land and ranges and the preparation of camping grounds occupies time which is available in other branches of the Service, either for training in their own special military duties or for training in co-operation with the other arms. The Royal Engineers being a *corps d'élite* composed of intelligent men who receive a very thorough preliminary instruction, have been able to overcome to some extent the disadvantage of this enforced curtailment of the periods of military training which they undergo. The field units of the divisions have always proved more than capable of carrying out such engineer duties as have been allotted to them. But this is not in itself sufficient. General Brialmont, perhaps the most distinguished of modern military engineers, used to say to his young officers, "To be an engineer it is first of all necessary to be a tactician." Now tacticians are rarely born. Of all branches of the military art, tactics requires the most constant theoretical study and practice, above all, practice. As a preliminary it demands an accurate knowledge of the requirements and capabilities of each part of an army, regular and close study of the use of ground under every variety of conditions, and constant training with troops. No one has recognized this more fully than the engineers themselves, and the most that is possible under the existing organization is now done; for the fuller training which is necessary the engineer officers of our field units have neither time nor opportunity. Further, when they come out on manœuvres their units are even more of a shadow of what they would be in war than is the case in other arms. Efforts have recently been made to overcome this difficulty by attaching men of other arms, such as spare numbers of the Royal Garrison Artillery, to the engineer field units during the periods of combined training. This is obviously a *pis aller*, which admits the evil but does not provide a permanent cure.

Nor are these the only defects of the present system. Owing to the difficulty of obtaining engineer officers to take part during the winter in regimental exercises and staff tours, and of employing the engineer field units at their proper work throughout the training season, officers

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of the other arms get very few opportunities either of studying theoretically or seeing with their own eyes the work of Royal Engineers in the field. The obvious remedy for these defects is to give the field units of the Royal Engineers more time for their purely military work. But in order to do this it is necessary to relieve them of their other duties—that is to say, some one else must be found to do these duties for them, and this will entail a very considerable increase in expenditure. Before this increase can be justified it is necessary to consider whether an equally good result cannot be obtained without it under some form of re-organization of the engineer services. To answer this question we must put past history out of our minds and inquire first what functions the engineers have to perform in war, and secondly, how the necessary numbers of engineers to fulfil these functions can be provided and trained.

OUR REQUIREMENTS IN ENGINEERS.

Taking the cavalry first, we require with the cavalry division an engineer headquarters and a certain number of field troops—our present establishment says four—a signal squadron and a wireless signal company. The field troops are required to assist the cavalry in the improvement of roads and other means of communication, in the passage of rivers, in placing localities in a state of defence, in helping to interrupt the enemy's communications by the destruction of bridges, railways and telegraphs, and in the preparation and maintenance of watering arrangements. They are equipped with tools and appliances for these purposes. None of these duties can be considered to be of a highly technical nature. Many of them, such as the passage of rivers, the defence of localities and the simpler forms of demolition, the cavalry are already trained to carry out for themselves. There is no reason to suppose that men of the same type as the cavalry trooper could not, if they were free to devote the necessary time to training in these special duties, reach the same standard of efficiency as that now attained by the field troops in the reduced period of training. The signal squadron requires only a small proportion of experts, the majority of its *personnel* being obtained in the same manner as the regimental signallers. In the wireless signal company we have a highly technical unit, the great majority of the *personnel* of which must be experts. In this case, therefore, a higher rate of pay in order to attract men of superior education and intelligence is justifiable.

With the divisions we require an engineer headquarters and a certain number of field companies. At present two are allotted to each division, but it is a matter for consideration whether a more convenient distribution might not be devised. We also require a signal company. The duties of the field companies are very similar to those of the field troops. They are needed to assist in the construction of works of defence, in the allotment of working parties, to improve and occasionally to construct roadways and bridges, to strengthen captured localities, to prepare and maintain watering arrangements, and to carry out demolitions. Again, none of these duties can be considered to require a high degree of expert skill. As regards the most important of them, the construction of defences, it is an accepted principle that the fighting troops must themselves be able to carry out all except the most elaborate

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forms of entrenchment. The field companies are only needed to assist in the more difficult work such as drainage, revetments and bombproof cover, where field defences are likely to be occupied for a considerable period. As in the case of the field troops, it cannot be said that there is any justification for employing experts—paid at expert rates—on such work as has been mentioned above.

Besides the engineers with the divisions there are a certain number of engineer units classed as Army troops. These consist of cable and air-line signal companies, the majority of the *personnel* of which are required to be expert telegraphists. There is also a bridging train, which consists merely of a reserve of bridging material, the labour for the construction and repair of bridges being obtained from other sources.

Lastly, we come to the engineer units required on the line of communications. These include a signal company, various railway establishments and companies, a works company and a printing company. The greater part of all these units must be experts, though whether it is necessary to maintain the whole or even a large part of this expert *personnel* in peace will be considered later.

In addition to the above there are certain technical units of engineers maintained for special purposes, but which are not included in the normal establishments of the Expeditionary Force. These include fortress companies and survey sections.

It will be seen that these duties can be divided roughly into two categories, those which are chiefly military and only partly technical, and those which are chiefly technical and only partly military. It will also be observed that those units whose duties are chiefly military belong to the divisions, and that those units whose duties are chiefly technical are employed either with the Army troops or on the lines of communication. This is for our purposes a convenient arrangement, for it is to the former that we wish to give more time for their purely military duties. But if we propose merely to relieve field troops and companies of the work of barrack maintenance and construction, so that they may be able to co-operate more fully than at present with the other troops of the divisions, we may be asked why we should pay a comparatively high wage to troops whose duties are no more technical than, say, those of the Royal Artillery, and at the same time provide some one else to do the work which was the only justification for increased pay. Such an argument would be unanswerable. It cannot be said that the military duties of field troops and field companies require greater skill or intelligence than does the handling of an 18-pounder quick-firing gun. We are therefore driven to the conclusion that if the whole time of the engineer field units is to be devoted to field work we must change fundamentally the conditions under which they are at present raised.

Remedies Suggested.

In considering what those conditions should be we have the experience of others to guide us. Both in foreign armies, and to some extent in our Indian Army, pioneers have long been a valuable complement of the other fighting troops. Pioneers may be defined as fighting soldiers, trained in field engineering, who co-operate directly with the other fighting troops; engineers, in contradistinction to pioneers, being

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experts who, although they are combatants, are maintained for technical functions, and whose employment on other than technical work must be regarded as abnormal and generally undesirable. It is suggested that we should raise our field troops and companies on a pioneer basis—that is to say, that they should be raised and paid as soldiers pure and simple and not as experts, and should devote the whole of their time to their military duties. If a body of officers and men, recruited in a similar manner to, say, the Royal Artillery, and paid at the same rates, are free to devote the whole of their time to the duties which have been described above as pertaining to field troops and companies, there is no ground for supposing that they will be unable to attain to the standard of efficiency in their special duties which is now reached by the engineer field units, and we shall gain the great advantage that there will be time available for the higher training in co-operation with the other arms which is at present, to a great extent, lacking. There is good reason to expect that the saving effected by raising the engineer field units in this manner will enable us to provide without loss of efficiency for the peace duties which they at present perform. Some of this work is already put out to contract and carried out by civilian labour. It is reasonable to suppose that, if the whole of it were handed over to those whose livelihood depends upon their skill, it could be carried out with at least equal efficiency and economy. It may be well to follow the example of the ordnance factories and to establish a small Inspection Staff of military experts to supervise the work of the civilian contractors. This is a point which can best be solved by experiment. If it is proved to be advisable the responsibilities of the Royal Engineers should end with such inspection, for the purely peace work of construction and maintenance can only be carried out to the detriment of their military work.

If the *personnel* of the engineer field units is to be raised and trained as pioneers, it remains to be considered whether the existing system of training of the young officers of the Royal Engineers is that most suited to the changes here proposed. At present those who are ambitious of joining the Corps of Royal Engineers as officers join a military college in which they meet only candidates for commissions in the Royal Artillery. The aspirant to a Royal Engineer Commission begins to specialize to a great extent at once, in that more of his time is devoted to the study of mathematics, mechanics and chemistry than to general military duties. When he has completed his course at the Royal Military Academy he passes to the School of Military Engineering, where for two years his time is almost entirely devoted to specializing in engineer duties. Since the goal of military training is co-operation, it is at least doubtful whether the way to it is best prepared by separating the cadets and young officers of the various arms at the outset of their careers.

The writer once happened to be in a small German town when a party of some 50 under-officers, who were on a tour of instruction, came in to pass the night. The party consisted of a batch which was approaching the end of the course of training for commissions as officers. The medley of uniforms was striking, all arms and most of the services appeared to be represented. One of the under-officers, when asked whether the whole went through the same course of training together, replied: "Oh yes! you see we must each know all about the tactics of the others." There

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can be little question but that this is the true foundation of that *camaraderie* between the various arms in which we as an army are to some extent deficient. If Brown of the Engineers has served as a cadet side by side with Jones of the Artillery, Smith of the Infantry and Robinson of the Cavalry, he is more likely to keep in touch with them and to take an interest in their professional needs than if he only meets them casually at a later period of his career. As long as engineers are regarded as experts first and soldiers afterwards there may be good reason for early specialization ; but if the principle of devoting the whole of the time and energies of the field units to military training is accepted, the corollary seems to be that the engineer cadets and young officers should first of all receive a general military training in common with the other arms, and should not specialize until they join their units But it may be argued that it has already been admitted that we require a certain number of experts for special duties with the Army troops and on the lines of communication, and that the officers who are to perform these duties must specialize. There does not appear, however, to be any reason why those engineer officers who elect to serve in the technical branches should not be allowed to make their choice, as is at present the case with the Navy, after, say, two or three years' service, and should then begin their special training. They will certainly perform their special duties more efficiently, if they are equipped with a sound general military education.

This brings us to the question of the raising and training of the technical units. The most important of these from the point of view of the Expeditionary Force are those concerned with various forms of telegraphy and with railway work. But both telegraphy and railway work in almost all the forms in which we require them in war are the means of livelihood of certain sections of the population. It is obviously more economical for us to obtain our experts ready trained from civilian sources than to enlist men who know nothing of these businesses and to train them ourselves. On the other hand, we must be certain of obtaining our requirements immediately on mobilization. Again, all who are employed with an army in the field in any capacity must be to some extent disciplined, and have some general knowledge of military organization and of the conduct of war. Lastly, we require a certain nucleus of experts, more especially of telegraphists, to assist in the peace training of the remainder of the army.

In order therefore to strike the balance between economy in peace administration and certainty in obtaining our requirements in war, the best method would appear to be to form permanent cadres for these technical units and to fill the cadres on mobilization from those whose civilian occupations give them the technical training we require. To be certain of obtaining these men when and where we want them they must be enlisted in peace on what is known as a special reserve basis—that is to say, they engage in return for a retaining fee to come out when required and receive in peace a small amount of general military training. This method has already been adopted, mainly in the railway units, and is capable of gradual extension to almost the whole of the technical branches of the Royal Engineers. The size of the cadres of these various technical units can only be determined by experiment, for it must to a

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great extent depend upon the number of special reservists of the several categories which is forthcoming. An exception must probably be made in the case of the Survey Section, which is required to prepare in peace the maps for all possible theatres of war. As long as large areas in which we may have to fight remain unmapped, the establishment of the Survey Section must depend rather upon the amount we can afford to pay annually towards completing such work as remains to be done, and keeping such work as has been accomplished up to date, than on our requirements in war.

SUMMARY OF PROPOSALS.

To sum up, it is proposed that the engineer field units required for duty with divisions should be raised and paid as soldiers and not as experts, that the whole of their time in peace should be devoted to training in the duties which they will have to perform in war; that the technical units required for duty with the army troops and on the lines of communication should be maintained in peace as cadres only, to be completed on mobilization from special reservists enlisted from those whose civilian training gives them the necessary technical skill; and lastly, that all engineer officers should receive a general military education in common with the officers of other arms, those required for duty with technical units specializing after they have received such an education.

It is not suggested that the whole of these changes can or should be carried out at once. In our voluntarily enlisted army such modifications can only be introduced successfully as the result of slow and careful experiment. The effect upon recruiting, both of officers and men, and upon the requirements of the various parts of the Empire, must be scrutinized. Further, we cannot follow too closely the analogy of continental armies, for we must remember that those armies, with compulsory military service, are able to select for duty with their engineer units those whose peace vocations specially suit them for such employment. It may therefore be necessary for us to enlist a small nucleus of experts, such as smiths and carpenters, for duty with the pioneer companies if it is found that the necessary degree of skill in these crafts cannot be obtained in any other way. Lastly, in dealing with a body of men of the splendid traditions of the Corps of Royal Engineers we must be prepared to make a considerable sacrifice of logic to sentiment, which in any army—but more especially in ours—has a very real military value.

One thing is, however, certain, and that is that the days are past when the duties of the fighting soldier can be learnt by any one in his spare time. The sapper on the strength of one of our divisions must be recognized as being as much a fighting man as the trooper, the gunner or the foot soldier. Each is an essential part of the complete fighting machine. The successful conduct of a cavalry charge or of an infantry attack, the successful co-operation of artillery with the other arms, are as much the result of technical skill and high training as the work of the engineer troops and companies. Each requires the entire time and application of those who have to carry it out. A system which requires a portion of the fighting troops to devote a part of their time and energy in peace to work which has little connection with their duties in war is difficult, if not impossible, to justify under the conditions of modern war.

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THE ENGINEERS OF THE EXPEDITIONARY FORCE.

By LIEUT.-COLONEL R. H. H. BOYS, D.S.O., R.E.

"N.C.O.'s and men should be given every opportunity to improve their trade and other qualifications, efficiency as a tradesman being an important qualification of a good sapper."—*Engineer Training*, 1912, Chapter II., Section 8, para. 2.

IT was a somewhat curious coincidence that in the April number of *The Army Review* an article on "The Pioneers of the German Army" appeared with Lieut.-Colonel Maurice's article on "The Engineers of the Expeditionary Force," as the information given in the former is useful in considering some of the arguments put forward in the latter. One knows that the views expressed by Lieut.-Colonel Maurice are held by some officers in the Army, and when they are put forward by an officer holding the position of Instructor at the Staff College, more especially when that officer is Lieut.-Colonel Maurice, they must receive very careful consideration. There is no doubt a great deal which is correct in them, but it is by no means certain that the proposals he puts forward would furnish a remedy to the defects in the present system which he enumerates, or that they would assist in meeting the requirements which engineers are required to fulfil.

Lieut.-Colonel Maurice admits that the Royal Engineers, as at present raised, have not failed in the duties which they have up to now been called upon to perform in war, though he seems to think this may happen in future. Before, therefore, we proceed to change an organization which has not hitherto failed, it is necessary to examine very carefully in all its bearings the effect of any alteration in it. It does not seem that this has been fully done in Lieut.-Colonel Maurice's article. The *rôle* of the engineers in war time is to assist the other arms to secure success, and any alteration in their organization which will enable them to carry out this *rôle* more efficiently will be warmly welcomed by the engineers themselves. There is no intention to claim that their present organization is incapable of improvement, and in this article it is only proposed to deal with the alterations Lieut.-Colonel Maurice suggests in order that the full effect of them may be realized.

First of all let us see to what he is referring. The article is headed "The Engineers of the Expeditionary Force," but it is stated that: "the object of this paper is to examine this problem as it affects one of these corps which perhaps presents the greatest difficulties, namely, the Corps of Royal Engineers." Are the "Engineers of the Expeditionary Force" and the "Corps of Royal Engineers" synonomous terms? An examination of the *Army List* will show that there are in the Corps of Royal Engineers many fortress companies, some field, signal and survey companies, and a colonial survey section which do not belong to the Expeditionary Force. The engineers with the Expeditionary Force consist of field troops, field companies, divisional signal

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companies, army troops signal companies, lines of communication signal company, bridging trains, works company, railway companies and printing company. In addition, some of the fortress companies already alluded to are allotted for duty on the lines of communication as field companies pending occasion arising for their use as siege companies.

Let us, therefore, be quite clear what we are talking about before we set to work to re-organize the "Corps of Royal Engineers." It would seem that Lieut.-Colonel Maurice in his article proposes to deal only with the engineers of the Expeditionary Force, although he mentions that: "In addition to the above (viz., the engineers with the cavalry, the divisions, and lines of communication), there are certain technical units of engineers maintained for special purposes, but which are not included in the normal establishments of the Expeditionary Force. These include fortress companies and survey sections." These technical units, which are thus somewhat casually referred to, form a considerable portion of the Corps of Royal Engineers, and they cannot be left out of account in any change of organization which is under discussion.

We will, however, put them on one side for the present and deal first with those units of Royal Engineers which are required with the Expeditionary Force.

Lieut.-Colonel Maurice divides engineer duties into two categories: viz., those which are "chiefly military and only partly technical," and those which are "chiefly technical and only partly military," and he states that those units whose duties are chiefly military belong to the divisions, and that those units whose duties are chiefly technical are employed either with the army troops or on the lines of communication. The military duties referred to apparently consist in co-operation with other arms, and the object of the remedies suggested is to obtain this fuller co-operation. The view that this co-operation is necessary before engineer units can properly perform the work for which they are intended will be agreed to by every engineer officer; it is insisted on in *Engineer Training*, 1912, and no one will be better pleased than the engineer officers concerned if such fuller co-operation can be arranged. If, then, this point is so generally agreed upon, why is it not carried out? Is the reason that which Lieut.-Colonel Maurice asserts, viz., that the employment of these units in barrack maintenance and construction prevents it? To answer this question we must subdivide the engineer units with the divisions, and consider the field troops and field companies separately from the signal units, as the latter are never employed on barrack work, so any failure on their part in co-operation with other troops cannot be due to this cause.

It will be well before we start on this subject to have clearly in our minds what is the object of employing these engineer units on "barrack maintenance and construction." It is that the tradesmen in these units may have opportunities of keeping themselves efficient at their trades. The question of the necessity or otherwise of having tradesmen at all will be dealt with later, but assuming for the present that they are necessary, opportunities must be provided during their period of service for them to work at their trades in order that on return to civil life they may obtain employment as tradesmen. If such oppor-

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tunities are not given, you will not get such men to enlist. It is clear that if these opportunities must be given, the most economical way of doing so is to employ the men on work which would have to be done by civilians if the engineers did not do it. It is not, therefore, out of consideration for the work that the men are so employed, but that the kind of man who has up to now been considered necessary for the efficiency on service of engineer units may be obtained and may be kept fully trained.

Let us now take the case of the field troops and field companies. In *Engineer Training*, 1912, it is laid down that collective training begins on March 1st and ends on October 31st. The men are therefore only employed at their trades during the remainder of the year, and it is apparently these five months which are considered wasted as regards training for their military duties. What is the period of training of pioneers in the German Army? The middle of October to April 30th is with them occupied in recruits' drill, individual instruction, section, company and battalion drill, and only May 1st to the middle of October is spent in technical training. According to *Engineer Training*, 1912, March and April are with us spent in what may be termed purely military training, so it is clear that our units spend exactly the same number of months at their technical training as the corresponding German units do. If, therefore, this period is found sufficient in the German Army to acquire the necessary co-operation, why is it not so with us? It is difficult to understand how it can be due to the employment of the men of these units at their trades in the winter months.

I venture to suggest that the reason is very different, and lies in the difficulty of arranging effective co-operation with other arms in peace time. Those who have had to do it know the difficulty of giving the engineers any actual work to do on tactical exercises. Too often all that can be accomplished is the laying down of a tape to represent a trench, or the erection of a notice to say a bridge is blown up, the units waiting about all the rest of the day doing nothing, and the instruction so gained either by the engineers themselves or by the other arms with whom they are co-operating is of very little use. The way to overcome this difficulty is now receiving a great deal of consideration, not only from engineer officers, but also from the senior officers of the Army. It is a question beset with difficulties, owing to the conditions under which tactical exercises have to be conducted in peace time in this country. It is very rarely that ground can actually be broken, walls loopholed, or communications improved in peace operations; and when to this is added the fact that these operations are conducted so much more quickly than would be the case on service, and that, even when the necessary facilities exist, time does not permit of the actual work being done, it is clear that very little idea can be gained of what constitutes the work of the engineers. It seems probable, however, that since all those concerned are really endeavouring to overcome the difficulty, all that it is possible to do will be done. In any case the alteration in the class of man composing the units concerned will not affect the question of this difficulty one way or the other.

In peace time it is exceedingly difficult to realize what the work which

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engineers have to do on service actually entails. This work is laid down in *Engineer Training* in general terms, but when it comes to carrying it out, matters present themselves in a different light. There is no doubt that a great deal of the work which field troops and field companies would be required to do—such, for instance, as the removal of obstacles, marking communications, etc.—does not require highly technical skill, and experts are not necessary for it. No doubt, too, that with sufficient training, men of average intelligence without any special trades would be quite capable of constructing a pontoon bridge. On the other hand there are very many of the duties in which technical skill is required. If a road on the side of a hill wants repair, a mason will be invaluable for running up a supporting wall. A pontoon is damaged: is not a carpenter necessary for its repair? In water supply is not a smith or fitter necessary to tap a main or repair a tap? Such instances might be multiplied indefinitely. Even a trestle bridge will be erected much more quickly and securely by men whose trade it is to deal with timber and fit parts together.

In this connection attention must be drawn to the present system of supply by mechanical transport. The supply columns are required to come close up to the divisions, and where mechanical transport is used many cases of improvement of roads and strengthening of bridges will doubtless occur. The demarcation of the limits of the lines of communication is not very clearly defined in this connection, but with divisions scattered over a considerable area the engineers of the lines of communication will be unable to follow up these supply columns everywhere, and any engineer work required to enable them to reach the troops will fall to the divisional engineers. This work must be done rapidly, and the advantages of men possessing trade qualifications with these engineers will then be great.

One of the many duties mentioned in *Engineer Training* is the organization of field workshops for the repair of tools, and tradesmen are a necessity for this.

Now let us see what is found to be required in foreign armies, and in doing so let us be certain that we are not making a mistake over the term "pioneer." Lieut.-Colonel Maurice gives definitions of "pioneers" and "engineers" referring to the duties which the two have to perform, and suggests that our field troops and companies should be raised and paid on a pioneer basis, that is, "as soldiers pure and simple and not as experts," by which presumably he means "as tradesmen." The question of pay will be dealt with later, but we must first see whether foreign armies consider tradesmen unnecessary in their "pioneer" units. Referring to the article on the pioneers of the German Army we find it stated that the majority of the men in pioneer units are "ferrymen, fishermen, deck hands, woodcutters, masons, bricklayers, smiths, carpenters and tailors." The Japanese lay down that a certain proportion of the annual contingents for their engineers must be of specified trades. In Russia, too, men with a trade are selected from each conscript contingent for service in the engineers.

If, therefore, foreign nations who have conscript armies make a point of putting tradesmen in their pioneer units, there must be a necessity

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for them. In such armies every arm will probably contain a number of tradesmen, and, provided the necessary tools are forthcoming, any unit, whether infantry, cavalry, or artillery, would be able to produce men capable of carrying out any ordinary job requiring technical skill. Unless, therefore, the need for tradesmen in the pioneers was specially felt, they would not take so much trouble to ensure that the large majority of these units were tradesmen. If this class of man is found necessary with them it will be more so with us. Are we to give no consideration to any warfare except in a civilized country in a temperate climate? Shall we always be fighting in a country where there is a community equipped with all the resources of civilization? Lieut.-Colonel Maurice, in introducing the question of the functions which our engineers have to perform in war, says: "We must put past history out of our minds." Surely this is a novel and rather dangerous proposal. The British Army and the engineers with it have fought in nearly every country in the world, and is it certain that we shall never have to do so again? In an uncivilized country the duties referred to as "chiefly technical and only partly military" become more than ever important, and the army whose engineers cannot carry them out will be badly off indeed. Of course war in a civilized country is our main consideration, but when those nations whose armies are organized solely for war in such countries find it necessary to fill their pioneer units by tradesmen, surely it is not sound for us, whose army is not unlikely to be required to fight in uncivilized as well as civilized countries, to alter our existing organization so as to abolish tradesmen from those of our engineer units which are required for the same duties as the "pioneer" units of foreign armies. Lieut.-Colonel Maurice seems to have overlooked the fact that a step in this direction has already been taken, and that a proportion of the men in our engineers at the present time are pioneers, that is, men without a trade. We must be careful to avoid any misconception on this point. When we speak of "pioneers" we refer to men without a trade, but this is not the case in foreign armies. The actual proportion of the strength of a field company in pioneers is not yet decided, but there is little doubt that it will be at least 33 per cent., and may be 50 per cent.

It is now necessary to see what it is proposed to gain by the remedies suggested. The advantages claimed appear to be two, viz :—

(i.). That there will be more time available for training in co-operation with the other arms.

(ii.). That the saving in pay between tradesmen and pioneers will be sufficient to cover the cost of executing by civil labour the barrack work done in the winter by the Royal Engineers.

As regards (i.), if the trade training is abolished, the only additional time gained will be the winter months between October 1st and February 28th. *Training and Manœuvre Regulations*, 1909, lays down that at home the first period of "individual training for officers and trained soldiers" consists of the four winter months of November, December, January and February. *Infantry Training*, 1911, Part I., Section 6, lays down the kind of training which is comprised under "individual training,"

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and none of the headings are such that co-operation between engineers and infantry can in any way be practised. *Cavalry Training*, 1912, in detailing individual instruction, mentions field engineering as one of the subjects to be taught, but a reference to Section 156 will show that the training is to enable cavalry to carry out certain work "unassisted," so in this case co-operation is not wanted during this period. In *Field Artillery Training*, too, the technical engineering work to be taught under individual training is not such that co-operation will be of any use. It is difficult, therefore, to see how the proposal is going to assist matters in this respect.

As regards (ii.), we have to bear in mind that the conditions of our service are wholly different from those of conscript armies. In their case tradesmen are compelled to serve, whereas with us if we require to obtain such men we have to compete with civilian employment and offer such wages as will attract the class of man required. Even if we abolish tradesmen, the only saving effected will be the difference in pay between the sapper and the pioneer. There will be no saving in barrack accommodation, cost of rations, etc. Taking as an average that the sapper receives engineer pay at the rate of 1s. 4d. *per diem* (which is a fair average) as against the pioneer's 6d., the saving will be 10d. *per diem*, or £15 4s. 2d. per annum. Allowing for furlough of 1 month, the sapper works at his trade for 4 months, or say, 16 weeks. The amount saved over one pioneer will, therefore, not suffice to pay a civilian even £1 per week during that time. The wages of civilian tradesmen are more than that, and in these days of trades unions the soldier will not get through less work than the civilian tradesmen in the same amount of time. It seems clear, therefore, that the statement that if the work now done by the sappers were "handed over to those whose livelihood depends upon their skill it could be carried out with at least equal efficiency and economy," is hardly borne out as regards the question of economy.

In his "Summary of Proposals" Lieut.-Colonel Maurice admits that "it may be necessary for us to enlist a small nucleus of experts, such as smiths and carpenters." In our Army we get no tradesmen to enlist as a general rule except in the Royal Engineers, and we shall not get them even in the Royal Engineers unless we afford them opportunities of working at their trades while in the service, so that when the time comes for them to return to civil life, they may be in a position to get employment as tradesmen.

The view that no tradesmen are necessary is clearly not the official view, as on reference to *Engineer Training*, 1912, Chapter II., Section 8, para. 2, there will be found the extract given at the head of this article, viz., "N.C.O.'s and men should be given every opportunity to improve their trade and other qualifications, *efficiency as a tradesman being an important qualification of a good sapper.*"

It has to be remembered that so recently as 1911 a committee presided over by Lord Kitchener was appointed to enquire into the organization and training of the Corps of Royal Engineers, and in their recommendations this committee put forward a proposal to introduce men of the pioneer type for a proportion of the strength of units, thus clearly showing that they considered tradesmen necessary for the remainder.

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A confirmation of the correctness of the official view will be obtained by asking engineer officers who have been on service whether they could have done the work they were called upon to do if they had not had tradesmen at their disposal.

Are we therefore once more " to put past history out of our minds ? "

It is somewhat difficult to follow Lieut.-Colonel Maurice's argument when he states that the work of the field troops and field companies requires no greater skill or intelligence than does the handling of an 18-pr. quick-firing gun. Possibly it does not, but the two cases are not comparable. There is no trade in civil life that includes the handling of a quick-firing gun, so in any case that must be taught *ab initio* in the Service. No doubt it requires men of intelligence to learn it, but the skill is acquired in the Service. If there were such a trade in civil life, the Royal Artillery would surely enlist men of that trade. The question now under discussion is the amount of skill which is necessary in the engineers to carry out the duties required of them, and not when that skill is to be acquired. Lieut.-Colonel Maurice maintains that, as far as the field troops and field companies are concerned, nothing but the skill which can be taught in the Service is required. If any skill which is learnt in civil life is wanted, it is obviously cheaper to enlist the man with that skill than to teach it him after he has enlisted.

What has been said above refers mainly, of course, to the men, but there is also the question of the N.C.O.'s to be considered.

The engineer N.C.O. frequently finds himself on service in a difficult position, such, for instance, as the charge of a small party without an officer, when he is expected to carry out all the engineer work required by the troops with whom he is. More often still he is placed in the position of supervising large working parties, or he is sent to carry out some technical job without an officer being present to tell him what to do or how to do it, and similar situations such as these might be multiplied indefinitely. It is necessary, therefore, that these N.C.O.'s should be men of superior intelligence, good education and ready resource, and such men are more likely to be found from among the tradesmen class. Do away with this class and introduce solely the pioneer class and you will very soon fail to get the kind of N.C.O. you must have if engineer work is to be satisfactorily carried out. This is quite apart from the question of a N.C.O. being personally skilled in some special trade, and the advantage of this when it becomes necessary for him to lay out and supervise work to be done by others can only be experienced to be understood.

We have, so far, only dealt with the work of field troops and field companies, and as the question as regards the training of officers refers to all classes of units, we will leave it to the end, and consider next the question of signal units. Among these we have the signal squadron, divisional signal companies, the army troops companies and the lines of communication company. The divisional signal companies are not specifically mentioned, but must apparently be considered in the same way as other signal companies. These, Lieut.-Colonel Maurice does consider as " technical units," but he seems to think their duties are all of the same nature, and he states that all the forms in which we

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require them in war are the means of livelihood of certain sections of the population, and that it is consequently only necessary to maintain them as cadres in peace time.

It is difficult to understand how such a statement could be made, and it would be very interesting to see a divisional signal company, composed solely of operators and linemen straight from the General Post Office, attempting to run the communications required by the divisional commander during some tactical operation. The work required of the N.C.O.'s and men of these companies bears no resemblance to the work which the men in the General Post Office do in their daily occupations. Divisional signal work requires the most constant training on the part of all ranks concerned before it can be efficiently carried out. What is still more important, unless all the three detachments of No. 1 Section of the company are available at the same time, a very wrong idea is obtained of the actual use to which such a company can be put in war. How then can useful peace training be got with such a company if there is only a certain nucleus of experts? The whole object of the proposals put forward is to obtain better co-operation between the engineers and the other arms, and yet their adoption in this case would absolutely prevent such co-operation taking place.

Then as regards the army troops signal companies, though their work does not always require to be carried out with the same celerity as that of a divisional signal company, it could no more be carried out by men straight from the General Post Office than could that of those companies. A visit to a signal office at headquarters on manœuvres will give anyone an idea of the amount of organization and training necessary before it will work smoothly. It is impossible here to enter into all the technical details which prevent the men of the General Post Office being fit for work in the field without previous training, but one point may be taken as an example: operators in the General Post Office have no knowledge of the connections of instruments, and when their circuits go wrong in the Post Office they wait till the testing officer or lineman comes to put them right. This, of course, is an impossible procedure in the field; and many other examples might be given.

It is not meant to imply that the men of the General Post Office cannot be utilized in any way for work in the field, but it is certain that before they can be so used they must receive special constant training, and that if the army troops signal units depended on cadres made up to war strength by men direct from the General Post Office the Army Signal Service as now organized would break down. As with the divisional signal companies so with the army troops units, the proposal prevents any training in co-operation with the remainder of the army. It has never been claimed that an infantry soldier is capable without any training of doing a gunner's duties, or that a gunner is capable of doing a cavalryman's duties because they are all soldiers, and it is not clear why it should be thought that General Post Office officials can do the work of the signal units because they are all telegraphists. The mistake may be pardoned in the latter case, as no one who has not had intimate connection with both branches can really understand the difference, but that does not render it any less a mistake.

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What has been said as to the signal units mentioned up to now refers in an even greater degree to the units which use wireless telegraphy; these are the signal squadron and the army troops wireless company. The men of these units must not only be trained in the pattern of apparatus they are required to use, but must be kept in constant practice with it. Moreover, there is no source at present available from which wireless operators can be obtained on mobilization; so, even if the men to fill up the proposed cadres were suitable, they are not obtainable. Wireless working in the field requires much experience, not only on the part of the engineers, but on the part of those in higher command who have to utilize it, and to make either the signal squadron or the army troops signal company only a cadre in peace time would effectually prevent any chance of this experience being gained, or of any assistance being given in the peace training of the remainder of the army.

All signal units now include a proportion of pioneers, and there is also a special reserve of telegraphists enlisted on exactly the lines that Lieut.-Colonel Maurice refers to. Our signal service is as complete as the communication service of any other nation, but no communication service will be efficient in war which is not maintained in peace time in a high state of training, not only on the part of those who have to work it, but also of those who have to use it, and the proposals put forward will effectually prevent any high state of training being obtained.

The bridging trains we need not refer to, as they are only a cadre in peace, and in war only consist of the necessary transport to move the bridging material about, with a small *personnel* to keep it in order. The *personnel* for the construction of the bridges is found by the field companies of the divisions.

We now come to the lines of communication units. These consist, as Lieut.-Colonel Maurice states, of a signal company, railway companies and railway transport establishment, works company, fortress companies and printing company. The signal company does not exist in peace time, so it need not be referred to.

The functions of the works company are to provide a skeleton military organization for work on the lines of communication, which would include all engineer works services, such as road-making, hutting, sanitary or water supply along the lines of communication. This company also forms workshops and works depôts for dealing with special engineer material. Lieut.-Colonel Maurice agrees that this is one of the units of which the greater part must consist of experts, and as its peace establishment is not large, it does not seem that any considerable change is proposed with regard to it.

The printing company is organized to carry out the printing, lithographic and photographic work required by the army in the field and on the lines of communication. The conditions under which such work is done in the field are very different from those in civil life, and the *personnel* must be thoroughly trained in peace time. This is arranged for by their being split up among the different stations where such work is mainly required. The number of the peace *personnel* is small, and as it is largely employed doing work which would otherwise have to be given out to civilian firms to do, there would be little saving in expense

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if this *personnel* were reduced, and the advantage of the necessary training would be lost. It is obvious that no one but experts could be employed in such a company.

As regards the railway companies, their work is of a highly technical nature for which experts are a necessity, and the problems which face the railway engineer in war are not altogether similar to those which have to be solved by the civilian engineer in peace time. Training in peace is therefore a necessity, and as the peace strength of these units is small compared to their war strength, they are but little more than cadres.

The railway transport establishment does not exist in peace time, so would not be concerned in the proposals under consideration.

The fortress companies are not specially organized for lines of communication duties. They are trained for siege work and are employed on general engineer work on the lines of communication only so long as they are not specially required for the work for which they particularly exist. Siege work is of an exceptional nature and obviously requires men of various trades specially trained, so that the proposals now under consideration are not applicable to these companies.

As far, therefore, as the lines of communication units are concerned, we see that the conditions which Lieut.-Colonel Maurice desires to have adopted are already to a large extent fulfilled, and that loss of efficiency would occur if further alterations on the lines he suggests were made.

We must now consider those other engineer units which do not form part of the Expeditionary Force, and to which reference has already been made as forming a large part of the Corps of Royal Engineers. As before stated, it is not very clear whether Lieut.-Colonel Maurice proposes to refer to these, but they seem to be all swept into his general proposal to have nothing but cadres for all units except the field units. If this is so, the proposal does not seem feasible, as it brings in the difficult question of service abroad apart from that of technical requirements. Of the units in question 1 signal company, 3 field companies, 15 fortress companies, and the survey section are serving abroad, and it is obvious that these cannot be reduced to cadres. There must be a number of similar units at home with which the *personnel* can be interchanged, and it follows, therefore, that as far as these units are concerned, the proposal to form them into cadres falls to the ground.

The survey companies are in peace employed on the Ordnance Survey, doing work which would otherwise have to be done by civilians, so that there would be no financial gain by converting them to cadres.

There only remains to consider whether the *personnel* of any of these units could with advantage be changed to pioneers.

As regards the signal company and field companies, the same arguments apply as in the corresponding units of the Expeditionary Force, and clearly it cannot be done in the survey units.

As regards the fortress companies, a large part of their duties consists in maintaining and working the defence searchlights of fortresses, and this work requires technical skill of a special nature which the pioneer—the man with no trade—could not perform. The remainder of their duties are concerned with the maintenance and repair of barracks and

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fortifications. The conditions abroad are entirely different from those at home, and even in those places abroad where civilians could be employed on the execution and repair of the defence works in war, these civilians would usually be natives who must work under military supervision, and a man with no trade will be little use in supervising the work of a native tradesman. In some places it might not even be possible to employ civilians at all in war time on such work, so in any case tradesmen are a necessity in these units.

The question of the N.C.O.'s is the same with regard to all these units, as it is in the case of those units we have already considered, so it is unnecessary to refer to them again.

There now only remains the question of the officers. Lieut.-Colonel Maurice proposes that all engineer officers should receive a general military education in common with the officers of other arms, those required for duty with technical units specializing after they have received such an education. Again we suffer here from want of explicitness. What exactly are the units referred to in which it is proposed that officers with no technical education should serve? Presumably the field troops and field companies. The proposal apparently is that the officers for these units are only to receive a general military education, and then to pick up their technical education as best they can in their units. It cannot surely be denied that technical knowledge is necessary on their part, as even if technical skill were not required from the N.C.O.'s and men, the officers who have to decide on and direct their work must have technical knowledge. For instance, before you can encroach on or extend an existing water supply the officer concerned must have a knowledge of water systems, otherwise serious results may ensue to the supply on which the Army depends. It is the same with drainage. Does the making or repairing of a road require no technical knowledge? Similar instances might be mentioned in nearly every piece of engineering work which has to be carried out. The control of all such work, whether in the field or otherwise, requires a knowledge of principles—principles not only of one kind of work, but of all kinds of engineering work, and those principles cannot be picked up. It is somewhat interesting to hear it suggested that engineer officers have too much technical knowledge, as one so frequently hears many witticisms directed at them and their work on account of their supposed deficiency in such knowledge.

The officers of field troops and field companies are apparently the only ones which it is proposed should not be technically trained. It therefore follows, if this proposal were adopted, that officers once in these units would have to remain in them. They would not be interchangeable with the officers of what are referred to as technical units. Here, then, we are face to face with that difficult question of a small body of officers who have to be kept to special work forming practically a separate corps by themselves. Surely the undesirability of such a condition is sufficiently well known by now to need no further elaboration here.

All other officers are to receive technical training, though whether that of the signal units is to be separate from, for instance, that of the

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railway units, is not clear. If that is the intention you are evidently forming more separate bodies of officers, until the whole of the officers of the Royal Engineers will be divided up into several small classes, none of which will be interchangeable. Is there anyone who will say that such a condition of things will be a change for the better?

The question as to whether it will be preferable to commence the training of the cadets for all branches of the Army at the same institution is a matter of opinion. It may be so, though it seems doubtful whether the advantages claimed by Lieut.-Colonel Maurice will be obtained. Cadets of the Royal Artillery and Royal Engineers are now trained at the Royal Military Academy together, but there is no clear indication that when these cadets become officers the Royal Engineers take more interest in the professional needs of the Royal Artillery than they do in those of the other branches and *vice versâ*. The proposal would cause a complete re-organization of our present system of training cadets and involve a considerable sum of money, but the desirability or otherwise of it is hardly a matter which concerns this article. One thing alone remains clear—that no matter at what period of their service it is given, officers of the Royal Engineers must receive a thorough technical training.

We have now dealt with all the questions raised by Lieut.-Colonel Maurice. It may safely be said that the Royal Engineers do not want a "considerable sacrifice of logic to sentiment" in such a case as this. They want the question judged by hard facts, but before it is judged they want the whole of the issues involved made clear. If, when this is done, it is proved that the Service will gain by such changes as are proposed, no one will be readier than they will be to see them adopted.

It is difficult to see how the proposals put forward will help to solve the question as regards the co-operation between the engineers and the other branches of the Army, and they will undoubtedly raise many other difficulties and involve consequences which will have very far-reaching and damaging effects. The Corps of Royal Engineers must be considered as a whole and not as so many separate compartments. Let us, therefore, be very certain, before we alter the organization of the Corps with a view to obtaining an improvement in one particular point, that we are not imperilling the efficiency of the whole. This is what seems likely would be the effect of the suggestions put forward, without any guarantee that the improvement in the one particular point desired would be attained.

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REVIEWS.

"VESTIGES OF OLD MADRAS."

(THE INDIAN RECORD SERIES).

By COLONEL H. D. LOVE, R.E.

THE Government of India, in determining to publish, for general information and without reservation, the records of the oldest of the Presidency towns, has been exceedingly well advised. Sir Richard Temple's handsome volumes on the administration of Streynsham Master have now been followed by Colonel Love's monumental work, and it is difficult to speak of this too highly. It has evidently been a most laborious undertaking, requiring years of research and entailing much wearisome copying of old documents; but in the end the author has succeeded in producing volumes which will form a standard of reference for all time. Confronted with an enormous mass of documents relating to every conceivable subject, he might have given us a volume of excerpts bearing on the historical and political occurrences of the period concerned (1639 to 1800 A.D.); another dealing with the topography of the city of Madras; another on military subjects, fortification, the army and the like. Each of these would no doubt have been of great value in itself and for its own purposes; but the effect on the public mind would have been different to that produced by a perusal of the present volumes. There would have remained a feeling of selection—a feeling that though much had been learnt much remained to be learnt—an impression that the reader had not quite got behind the scenes. This has all been removed by Colonel Love's judicious procedure. He proceeds chronologically for the most part, only grouping subjects together for a few consecutive years so as to avoid overmuch patchwork, and he publishes everything with merely a running comment and without any attempt at criticism or explanation. Each individual is left to form his own opinion on the facts; and it is exactly this quality which will make the work of such value to the Indians of to-day. They may distrust the statements of a historian and may doubt his accuracy or traverse his conclusions, but in this case they are introduced to the innermost minds and thoughts of the English merchants who dwelt in their midst, and the reasons for their actions; and they will be enabled to trace the growth of

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British power from its inception equally with the growth of every street and suburb of the city of Madras, not because someone *tells* them how these grew, but because they can see it with their own eyes. For in these volumes we have the original records, nothing is concealed, nothing brought into undue prominence; and after a perusal of them the reader is left with the satisfactory sensation that now at last he has clear vision, and can understand the reason for many things that hitherto have remained insufficiently explained.

From the point of view of politics it is not too much to say that the old Madras Records will stand as a sort of message to the world. A number of well-meaning but ill-informed philanthropists are never tired of asserting that the English went to India filled with the lust of conquest, and that their behaviour to the people of the country has always been that of conquerors towards the conquered. They affect to believe—perhaps they do honestly believe—that our empire in India is only maintained by what they call "British bayonets." And almost to a man the Indians themselves, being an entirely unhistorical race and absolutely ignorant of the truth, believe that up to the time of the arrival of the English all India lay under the government of a magnificent Hindu emperor, that all the arts and sciences flourished in the country, that all the people were happy, and that all were prosperous and well-to-do. This glorious condition, they say, was put an end to by an English invasion which effectually ruined the country. Filled with these ideas and naturally disliking the government, however beneficent, of an alien race, it is no wonder that they dream of a possible Utopia when this splendour shall be returned to their beloved land. This false belief is at the bottom of the unrest that has done and is doing so much harm in India.

The volumes before us afford a complete and triumphant answer to such vain imaginings. For more than a century and a-half after they had obtained from the local Hindu Governor, or Naik, a grant of land with a village or two standing on it, on which they constructed their first fort for the protection of their merchandise, the English relations with the Indians were such that their settlement became a place of refuge for all grades and classes, a place to which they fled for relief from the insufferable chaos and anarchy existing in all the country round them. One of the reasons which influenced the Naik in making the original grant was that he might have such a place near at hand to which he might resort when hard pressed by his foes. For all that long period the people of Southern India lived as best they could under conditions of almost inconceivable political confusion; and they flocked to Madras in such numbers that the population of that place increased in 50 years from 7,000 to 400,000 souls. Is it likely that they would have done so had they not looked on the English as their friends? Time after time the struggling rulers sent their families there for safety, and in the later years the Muhammadan Nawāb himself took up his residence there and built himself a palace within range of the guns of the fort. As regards the Naik's original grant in 1639 we have his own reasons given for permitting the English to settle. The merchants

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write to the "Honble. Company" in London stating the terms of the grant, and adding (Vol. I., p. 20) :—

> "They are fayre priviledges; and may be questioned why hee should make us these fayre proffers. 'Tis Answered by himselfe. First, he desires his Countray may flurrish and grow rich; which he Conceives it will by Draweinge Merchants to him. Secondly, hee desires for his money good Horses from Persia. Thirdly, that yearly upon our Shipps hee may send a servant into the Bay Bengalla, to buy him Hawks, Apes, Parratts and such-like bables [baubles]; . . . And lastly, *the fort, being made substantiall and strong, may bee able to defend his person on occasion against his insultinge Neighbours.*"

In 1692 the President at Madras reminded the then Grand Vizier of the Mogul Emperor of the terms under which the villages had been acquired—"Wee did not take them by force you well know: it was by your Order" (Vol. I., p. 579).

In order thoroughly to understand the appalling confusion and misery that prevailed in the country during the entire period from 1639 till peace and good order were established by the English after the defeat of Tippoo Sultan, it will be well to summarize in a few words the progress of politics. Full and interesting details will be found in the Records themselves. The territories now comprised in the Madras Presidency, measure about 150,000 square miles and are therefore about a third larger than the British Isles. Down to the 14th century they had been governed by several different Hindu monarchies, but never by one sovereign. In that century all the Hindus of the south were drawn together, terror-stricken at the near approach from the north of the dreaded Muhammadan conquerors. United under the Hindu sovereign of Vijayanagar they kept the foe at bay for two centuries, but in 1565 were completely defeated and their capital destroyed. The King, generally called "The Rāya," fled southwards and took up his residence at the fortress of Chandragiri about 70 miles N.W. of Madras, reduced almost to the position of a mere titular monarch; while the whole country was plunged into confusion and anarchy by the wars of a number of local chiefs, each striving for independence. When the English merchants arrived on the coast they found Southern India seething with strife, and in this condition it practically remained for a century and a-half. North of the Krishna River were five distinct Muhammadan kingdoms tearing at one another's throats. Supreme over them in name, but with little power, was the Mogul Emperor of Delhi, who was opposed to them all as being rebellious vassals. South of that river the whole peninsula was a battle ground for the levies of the several Hindu leaders, who also were often opposed by their own sovereign. Each of these contending parties had his own army, which wandered over the country plundering the villages and living by exaction. The principal Moslem armies whose doings affected the south, were those of Golkonda and Bijapur. Golkonda had seized territory north of Madras and was pressing southwards, being opposed by local Naiks (chiefs) and the Army of the Rāya.

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The principal chiefs, holding their territories nominally from the Rāya, rented out the several tracts to "Naiks." These in turn farmed out the villages. When in want of money the Rāya pressed the Naiks, and these harried the village farmers for the Rāya's as well as for their own supplies. The village headmen could do no less than plunder the villagers, so that these lived in misery and destitution. Writing about the English settlement at Armagon north of Madras in 1639 the Agent told the Directors that the Hindu merchants there were "miserable poore" *owing to "the Naigue's continuall forcings"; and again in a later letter said:—

> "That Naigue soe pills† and pols the merchants that they are not able to Comply with their Contracts."‡

To add to the confusion the Mogul Emperor Shāh Jahān took the field against the rebellious Shāh of Bījapur and defeated him in the north, while the latter's southern forces ravaged the country of the Hindus and seized part of Mysore. He granted a large estate to the father of the great leader Sivaji, and so laid the foundation for the power of the Mahrattas. This was in 1637. It was in the midst of all this turmoil that the English obtained their first settlement at Madras in 1639. Three years later the Golkonda Muhammadans advanced southwards towards Madras annexing territory as they came, and the Madras Councillors write of "Warrs and broyls increasing in this Countrey" and drawing near to them. In January, 1643, they report:

> "This Countrie being all in Broiles, the old [Hindu] Kinge of Karnatt [Carnatic] being dead; soe is the Naique of Armagon, whose Countrie is all in the hands of the Moores . . . The warr draweing soe nere hath caused us to take ashoare . . . 4 small peice of Ordnance . . ."§

The Naik who was friendly to the English was deposed and his territory was given to a noble who opposed them. The latter attacked the Dutch settlement, a little north of Madras, in 1645, and making peace with them, collected an army of 50,000 men to keep off the Golkonda troops. This army lived on the country. All the efforts of the Hindus were in vain. The Muhammadan King of Bījapur conquered the country as far south as Tanjore where he established a Mahratta dynasty; and the King of Golkonda openly assumed control of the territory in which Madras was situated, but remained on friendly terms with the foreigners.|| A year or two later the armies of the Mogul Emperor entered the peninsula seeking to subdue his vassals, while the Mahrattas, now in great strength under the renowned Sivaji, attacked the new territories acquired by the King of Bījapur. We find the Madras merchants writing to the company in London in 1654:—

> "It hath been no small miserie that this poore . . . Country hath suffred any time these ten years almost . . . What the issue of theis things willbee, the Almighty onely knoweth. . ."¶

* Vol. I., p. 16.
† Pillages.
‡ Vol. I., p. 53.
§ *Ibid*, p. 21.
|| *Ibid*, p. 76.
¶ *Ibid*, p. 115.

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And in 1661—" Wee have 5 or 6 Armies within the Compasse of 100 miles about us."*

Previous to this, however, in 1656, there was fighting close to Madras between the Hindus and Muhammadans, the latter plundering and burning the houses in the vicinity of the town, and in the following year the place itself was besieged for seven months. At this time, the English in the fort who could bear arms were only about a dozen in number and the company took into their employ some of the Indian townsfolk, paying them to assist in the defence.† Sivaji now assumed the title of Rajah and warred against both Hindus and Moslems. In 1662 the Golkonda Army attacked the Portuguese settlement at St. Thomé, 4 miles south of Madras. The next few years saw fighting all round, and the position of the English was rendered very precarious by their being for a time at open war with the Dutch who attacked them by sea. In 1670 the Army of Golkonda blockaded the fort, while other armies hovered in the neighbourhood, and the company were pestered by demands for money made by " Flyinge Armies hatchinge Rebellion "‡ each of which seemed to be acting independently.

To increase their difficulties still further France declared war against England in 1672 ; and the French drove out the Golkonda garrison from St. Thomé and seized it, while the Dutch blockaded the coast. The latter then expelled the French from St. Thomé and handed it over to the Muhammadans, whose king befriended and assisted the English and gave them a charter for their small possession. The Mahrattas now raided over to the east coast, took many neighbouring forts, and at the sword's point demanded aid from Madras against both Golkonda and the Moguls ; and in 1684 there arose a new terror in the fact that the Mogul leaders in Bengal were making war on the English settlements there, and for a time succeeded in driving them out of the country; a situation which placed Madras in a position of antagonism to the most successful of its warring neighbours. It is not surprising that at this juncture the company strengthened the fortifications of Fort St. George, and raised some levies amongst the native Christians, the garrison now numbering about 400 men.§

The Mogul Emperor Aurangzīb succeeded in crushing down the kingdoms of Golkonda and Bījapur in 1686 and 1687, but rebellions sprang up on every side, and the country remained under the oppression of a lawless soldiery and distracted by their excesses and exactions. Madras, however, was protected by the Mogul's Governor, and the Emperor renewed the charter. The Mahrattas at Ginji and Vellore were then attacked and years of strife followed, the Mogul Army not finally gaining the upper hand till 1698. Meanwhile in 1690 war again broke out between France and England and a succession of sea fights took place. Between 1700 and 1717 Madras was threatened on several occasions. The Moslem Nawāb of the Carnatic came down on it with 10,000 men in 1701, but retired. In 1702 he blockaded it and only raised the blockade on receipt of a heavy bribe. In 1703 the Nawāb's

* Vol. I., p. 197.
† *Ibid*, p. 167.
‡ *Ibid*, p. 280.
§ *Ibid*, p. 371.

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superior, the Subahdar of the Dekkan, only refrained from seizing the Madras villages on being boldly told that the company would defend their property by force.* Similar attempts were made by the Nawāb in 1709, 1710 and 1712, while in 1717 a body of his troops had to be driven out by the garrison.

About this time the Mogul Empire began to show signs of weakness and the Emperor's Viceroy, the Subahdar of the Dekkan, revolted and in 1724 established himself as an independent sovereign.

The south of India was now under the heel of the Muhammadans, and the Nizam was at feud with the Nawāb of the Carnatic; so much so that he induced the Mahrattas to attack the latter's territories, and in 1735 they ravaged the country. The anarchy everywhere became worse than ever when, in 1739, Nadir Shāh captured and sacked the Mogul capital Delhi, shaking the Moslem Empire in India to its foundations. There was another invasion of the Nawāb's country by the Mahrattas in 1740; the Nawāb himself lost his life, and his successor, Safdar Ali, sent his family for safety to Madras, which had become a place of refuge for everybody in times of difficulty and danger. Two years later Safdar Ali was assassinated by Murtazā Ali, who, against the wishes of the Nizam, tried to usurp the Nawābship. The Nizam then took the field with 120,000 men, secured the person of Safdar Ali's son, Sahib Jadda, then a minor, attacked and defeated the Mahratta invaders, and made Anwar-ud-dīn "Nawāb of Arcot," instead of "Nawāb of the Carnatic"—an appointment that was followed by the murder of the unfortunate youth, Sahib Jadda.

In 1744 there was again war between France and England, and the Madras garrison was therefore once more strengthened. Two years later the place was attacked by the French both by sea and land, the French ignoring the Nawāb's warning, issued both to them and to the English, to keep the peace. The garrison only numbered about 200 effectives and the English were forced to capitulate; upon which the Nawāb's son, Mahfūz Khān, unwilling to allow the English to be driven out, attacked the French, but failed. Madras was restored to the British Company in 1749 by the treaty of Aix-la-Chapelle.

Enough has been said to show that for over a hundred years the English in Madras never dreamed any dream of conquest, and that their relations with the people of the country were of the best. The story could be continued and the reasons shown why the Nawāb favoured them instead of the French; why the English assisted him; and why, after peace was made between the French and English, he gave at last a large tract of country into their charge; how, after the terrible events in Bengal culminating in the tragedy of the "Black Hole of Calcutta," Clive was sent up from Madras, and decisively defeated the Muhammadan Army; how this led to the English at last realizing their power and strengthening their position; how they were compelled by the atrocities of Hyder Ali and Tippoo Sultan, the usurpers of Hindu Mysore, to take the field against them; and finally how, with the capture of Seringapatam and the death of Tippoo, they, by agreement with the Nizam,

* Vol. II., p. 19.

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became possessed in 1800 of the territories conquered from the Hindus by Hyder and Tippoo, having previously received some districts from the Mogul Emperor. These things and much more are made plain by these Records, but space does not permit of the details being given here.

We have used the volumes so far for one purpose only. They may be used for many others. Thus, in order to convey some idea of the sufferings of the Hindu population of the country at the hands both of their own leaders and of the conquering Muhammadans a few extracts may be given. In perusing them it will be well to remember that since 1800, when Southern India practically came under British control, the country has been at perfect peace, good order has been everywhere introduced, taxation enormously reduced, and justice done, or attempted to be done, between every man and his neighbour. As regards taxation it will suffice to say that immense lists of separate taxes are mentioned in the old Hindu records, whereas under the English Government all have been abolished except agricultural rent, a cess for local roads, hospitals, and the like, and an income tax on merchants. The extracts are from the original letters and reports.

A.D. 1640.—" The froequent inforcements of those tyranous [Hindu] governors . . . mischeivous Attempts [of the] . . . treacherous . . . Inhabitants of that Country . . ."*

A.D. 1642.—" The [Hindu] Naique of Tanjour . . . puts in almost monthly (to him that will give most) a new Governor. ."†

Each new Governor, of course, sought to make what he could out of the people before he in turn was ejected.

A.D. 1642.—" Every Naique is a king in his owne Country. . ."‡

They were, that is, entirely beyond the control of their nominal sovereign.

In A.D. 1676 we read of a Hindu minister " pilling and squeezing the people,"§ and, enlarging on this, the agent at Fort St. George writes :

" The Government of the country is now in so bad hands, nothing but fraud and oppression, and so voyd of shame that no Creditt can be given to either agreements, [or] promises . . . These Bramanys now in power are so wholly sett upon treachery and surprisall that there is no relying nor confidence can be put in them."‖

This state of things continued. In 1714, the company at Madras, hoping to obtain a concession of the Island of Divi, state that they think that the island will speedily be well populated when in their hands, owing to " the insufferable usage under the Moors Government upon the main land."¶

* Vol. I., p. 37.
† *Ibid*, p. 45.
‡ *Ibid*, p. 46.
§ *Ibid*, p. 356.
‖ *Ibid*, p, 357.
¶ Vol. II., p. 155.

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In 1737 the state of the people was as bad as ever.

> "There have been frequent Robberys in the Great Townes as well as in the Roads, and the exactions of the Havildars has been so vexatious and intolerable to the Natives that several Towns and Villages have been deserted by the Inhabitants. In a word the Confusion and Disorder of the Country is exceeding great."*

When in 1725 the English authorities rented out one of their villages to a Hindu, one Mahādeva, the complaints of his tyrannies became so urgent that they withdrew his lease and turned him out.

That Madras really was a place of refuge for the people of the country and that they preferred to live under the protection of the English instead of under the iron hand of their own chiefs is well shown by the fact that when, in 1681, Madras was threatened with attack by a Hindu leader and was for a time actually blockaded by him the Hindu residents came forward actively to assist the defence—

> "Allsoe the Gentue and Malabar Inhabitants came and offered to maintain at their owne charge 215 men for the defence of the Towne, which was accepted of . . . The Mallabars alsoe came and offered to entertaine 150 men for the defence of this Towne, and the Washers 25 men, which was accepted . . ."†

The enormous and rapid growth of the population of Madras has already been mentioned.

In 1707 when some of the Hindu residents declined to pay a certain cess for local purposes they were compelled to do so not by any legal proceedings or by force, but by the threat that if they did not they would have to *leave the town and go back to their people.* This was quite sufficient. They submitted at once.

> "'Tis therefore unanimously agreed that they are made to pay the duty as formerly, or to leave the Place."‡

That the attitude of the English towards the people of the country was entirely peaceful till events beyond their control forced them to increase their garrison and take the field, in the face of overwhelming danger originating in the attacks of the French, is easily shown. So far from having entertained any ideas of conquest or annexation of territory we find that their soldiers numbered 33 in 1647, 26 in 1652, 10 in 1656. In 1662, after Madras had actually been besieged, they wrote home begging for 100 swords, and some good muskets, their own being so rusty that 53 of them burst on being tested. In 1678 they owned only seven horses.§ Even so late as 1744 the councillors of Madras wrote that they were very deficient in European troops:

* Vol. II., p. 278.
† Vol. I., p. 439.
‡ Vol. II., p. 112.
§ Vol. I., pp. 80, 109, 121, 170, 210, 211, 215, 452.

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> " The few Europeans We have in Garrison . . . [bear so] small a proportion to the Black Soldiers that [We] are ashamed to turn out our Guards at [a time] when the Great Men of the Country come [here] . . ."*

The volumes teem with passages showing that the English dealt with the Indians in a constant spirit of good will and sympathy. They tried their utmost, for instance, in times of famine and disaster to minimize their terrible sufferings by procuring food and help ; for which purpose private subscriptions were raised as well as assistance given from the public purse.

Colonel Love has, in giving us the whole of the original records worthy of publication, also included many very interesting passages bearing on the manners and customs of the times, as well as details of the many local squabbles and disagreements that took place amongst the leaders. Very quaint and amusing reading some of these. There is an account of the visit paid to Fort St. George in 1701 by the Nawāb, Dāūd Khān. Those who have read the autobiography of the valiant Emperor Bāber will remember how often and how sadly he departed from the tenets of the Korān with reference to the use of " strong waters." Dāūd Khān followed his example, and so, it is to be feared, did many of the English in those days. The Nawāb was received with great honour and entertained at a great banquet. At his reception—

> " The Governour sett by him two Cases of rich cordiall waters and call'd for wine, bidding him wellcome . . . The dinner consisted of about Six hundred Dishes small and great, of which the Nabob . . . eat very heartily . . ."

Next morning he was to have paid a visit to the ships,

> " but he having been very Drunk over night was not in a condition to go . . ."

He, however, asked permission to visit the company's garden instead, and after some delay the Governor proceeded thither to meet his guest. It seems that the Nabob was kept waiting for a reply from the Fort—

> " But before the Answer came to him the Nabob was got into a Portuguez Chappell very Drunk, and fell a Sleep."

Sleeping till the afternoon he sent his excuses to the Governor—" and desired him to send a Dozen bottles of Cordiall waters ; which were sent him."

Some years later he wrote to the Governor and asked for " one thousand Bottles of Liquor," but received only 250.†

That the English residents very often dined too well is clear from many passages in these volumes ; so much so that in 1659 a certain Roger Myddleton writes to his relations at home : " This is an expensive place, and from the drunkennesse thereof good Lord deliver me."

As before mentioned this work is very complete. It contains the

* Vol. II., p. 299.
† Vol. II., pp. 15—18.

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history of every institution in the city, shows how the place grew, the laying out of its streets, even the names of its residents at different times, their characters, and their adventures. Many Englishmen of to-day will find a notice here of some bygone member of their family. Special attention is given to the fortifications and to military details connected with the garrison. As an exhaustive narrative of the growth of a place, no less than of the growth of its institutions and its history, the work is probably unique. Many maps, plans, reproductions of pictures, drawings, and portraits enrich the volumes.

And, last but not least, allusion must be made to the elaborate index, which is so lengthy that it had to be bound up by itself as a fourth volume. The preparation of an index is always a very wearisome task, more especially so when the indexing of three large volumes has to be carried out. But for a work of this kind it is absolutely indispensable, and the public must be grateful not only to the author himself but to anyone who helped him. Colonel Love tells us in a little note on p. 575 of Vol. III. that much is due to the devoted assistance rendered him by his daughter; and we venture therefore to express our thanks to her as well as to himself.

ROBERT SEWELL
(*Late Indian Civil Service*).

ELEMENTARY THEORY OF ALTERNATE CURRENT WORKING.

By CAPT. G. L. HALL, R.E.

AN Engineer officer is always liable, in the course of his multifarious duties, to be called upon to instal electric lighting or electric motors in connection with barracks, cantonments or workshops, and it may frequently happen that the only source of supply available is of the alternating current variety; in these days, with the tendency towards large centralized generating stations and long transmission lines, this is becoming more and more likely to be the case. An officer confronted with a problem of this sort, assuming he has no previous experience to guide him, will naturally turn to a book for information.

There are of course many excellent treatises on alternating currents, but they are practically all calculated to appal the casual enquirer, who desires to get at the salient points without wading laboriously through abstruse mathematical investigations; such books, in fact, contain too much, and the searcher after knowledge is discouraged by a mass of detail, much of which he feels he does not require.

It is to meet the wants of such a one that Capt. Hall's book has been written; as he says in the preface his aim has been "to put before the reader the elementary principles in as simple a form as possible and to endeavour to rob electrical phenomena of the mystery with which they

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are often associated in the mind of the beginner by reducing them as far as possible to every-day mechanical equivalents."

In this laudable attempt Capt. Hall has been very successful; he has assumed a knowledge of elementary electro-magnetic phenomena and continuous current work and starting on this basis commences by a consideration of the factors which differentiate alternate from continuous current working, the first four chapters being devoted to a general description of the effects of inductance and capacity.

Power measurement in alternate current circuits is discussed in Chapter V. up to which point only single-phase working has been dealt with.

Chapter VI. treats of polyphase currents including methods of distribution and power measurements in such circuits, after which Chapters VII. and VIII. deal with transformers and alternating current generators.

The last three chapters are devoted to alternate current motors, synchronous motors being taken first, then induction motors and finally commutator motors of various types.

The subject generally has been treated diagrammatically rather than analytically, vector diagrams being freely employed, while the absence of reference to details of design or testing has enabled mathematics to be reduced to a minimum.

The book is characterized throughout by admirable lucidity and clearness of analogy. It can be confidently recommended.

A.H.D.

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NOTICES OF MAGAZINES.

DRESDNER NACHRICHTEN.

8th October, 1913.

THE COAST DEFENCES OF THE NETHERLANDS.

The controversy in connection with the defences of the Dutch coast has raged for some time, and at length the works are to be put in hand at once, in spite of the protests by England and France. A strong fort is to be built at Flushing, which will be armed with 28-centimetre guns in revolving armour-plated turrets. The old fort Kiykduin is to be brought up to date and is also to have a heavy armament. Finally, the modern-built forts at The Hook of Holland, Iymuiden and Harssens, are to have heavy guns of the latest pattern. The firm of Krupp at Essen has been selected after the merits of all other firms had been considered.

LES ARCHIVES MILITAIRES.

GERMANY.

(1). *School of Military Telegraphy.*—A new school of military telegraphy has been formed for the purpose of having a central establishment to instruct and organize all forms of communication used in the German Army. Special attention is paid to wireless.

FRANCE.

Flying Units.—The term " escadrille " is given to mobile flying units attached to staffs and headquarters, and which are capable of keeping up with troops on the march. Normally the six aeroplanes of the unit will fly, but a tractor and lorry is provided for each to drag them along in case of breakdown. Three motor lorries for spare parts and a movable workshop complete the unit. The latter four vehicles compose the train vehicles of the unit. A motor car is supplied for the use of the unit commander.

Wireless on Aircraft.—Great importance is attached to the provision of wireless on airships. It is pointed that all the French ships stationed on the Eastern Frontier are provided with it. Messages have been sent about 300 kilometres from a Zeppelin, the intention of the Germans being to fit these ships now with 500-k.m. sets and aim later at being able to send 1,000 k.m.

Military Ski-Men.—Men who can pass the requisite test may be given a certificate of ski-men and will on mobilization be employed as such if required. The tests which have to be passed are as follows :—

(1). Endurance Test.—The candidate carrying a Tyrolian knapsack with 5 kilometres weight in it, has to accomplish a march of 25 to 30 kilometres over a total difference of level of 800 to 1,000 metres at an average rate of 5 kilometres per hour. Failure to pass this test disqualifies the candidate.

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(2). Speed Tests.—The candidate has to cover about 4 kilometres of fairly level ground in any kit at a speed to be fixed by the examining board.

(3). Test for Style and Jumping.—The candidate has to do certain figures on a slope of one in five to one in seven, 300 metres long. The candidate next has to do two out of three 7-metre jumps off a 70-c.m. platform.

(4). Repair of Gear.—The candidate must be able to effect such small repairs as he might have to do for himself in the field.

Aeroplane Observers.—Arrangements are made to train special officers as observers; these come under the following headings:—(1). Staff college officers who have already undergone a period of training as aeroplane observers and are allotted on mobilization. (2). Officers of Class 1 but unallotted on mobilization. (3). Staff college officers as yet untrained in observing. (4). A certain number of cavalry officers.

Preference is given to officers who hold a Staff College certificate. These officers are specially considered for recommendation for the *Legion d'honneur.*

RUSSIA.

New Cavalry Training.—The front ranks of squadrons having recently been re-armed with the lance, the tactical use of this weapon is dwelt on. A new feature is "firing from horseback" which is only to be used in the "lava." The latter is a form of fighting hitherto only used by the Cossacks, but now made general for the cavalry. This manœuvre is employed to deceive the enemy and make reconnaissance more difficult for him, and consists in surrounding the enemy with a large number of small units who employ fire action either mounted or dismounted to harass the foe.

A. H. SCOTT.

NEUE PREUSSISCHE ZEITUNG.

5th October, 1913.

THE LAND DEFENCES OF FRANCE ON HER EASTERN FRONTIER.

By Major Oberlindober.—Senator Bérenger has written an article in *The Matin* which has attracted much attention, about the French land defences against a German attack, under the heading of "Lastrouée du Luxembourg n'est ni couverte ni fermée." After the war of 1870-71 the French generals laid themselves out to evolve a scheme to check a new German invasion, even though the mobilization of the latter should be on a far larger and more rapid scale. The general idea was to provide a line of resistance in the shape of strong frontier fortifications to cover the mobilization of their own army, which would be accelerated by the construction of a carefully thought-out network of railways.

The protection of the mobilization and the task of checking the enemy's advance, necessitates the defence of an extended line, or the defence of certain suitably defended sections at a convenient distance from the frontier, while the remainder of the task is to provide the necessary depth by the arrangement of defended fortress groups behind each other. The recommendations of the committee, which was formed to consider the defence scheme under the presidency of General Séré de Rivieré, were:—

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(1). Construction of two defended sections between the Swiss and Belgian frontiers on the upper Moselle and middle Meuse.

(2). The construction of two groups of fortresses each consisting of three fortresses behind the gap between the two defended sections, as well as between the northern section and the Belgian frontier (Besançon—Dijon—Langres in the south; Reims—Laon—La Fére in the north).

(3). Reconstruction of the capital (Paris) as central fortress and "keep" for the whole defence scheme.

In addition to these arrangements, directed against Germany, the most important forts and fortresses on the Belgian frontier were to be kept and a few less important ones given up. The defended sections (*Rideaux defensifs*) consist of a line of mutual, supporting detached forts and batteries while the wings are formed of large defensive areas (*camps retranchés*). As a rule these forts are placed in naturally strong positions, and on the whole are pretty modern, though some are getting out of date. The searchlights and means of communication are of the most modern type and many of the guns are armoured. Their garrison averages one or two companies of infantry, or one battery of foot artillery.

The large defences on the wings are composed of a double ring of up-to-date forts enclosing a defensive area of 45—50 kilometres in circumference with long-range guns and a garrison of forty-five to fifty thousand, which is also available for offensive measures on a considerable scale.

Of the southern section, the line of the upper Moselle is taken as a natural obstacle. All roads leading to this valley are covered by forts situated on the ridge of the Vosges. The strong right wing is formed of the defensive area of Belfort and the fortress groups of Mont Béliard and Loment. The front consists of the forts Giromagny, Ballon de Servance, Chateau Lambert, Rupt, La Beuille, Remiremont, and Arches, whilst the left rests on Epinal. The northern section has its right on the mighty fortress of Toul, Bourlémont and Pagny and the fortifications on the plateau of de la Haye. The front consists of the forts Gironville, Jouy, and Liouville, Camp des Romains, les Paroches, Troyons, and Gémicourt. The first three lie on the eastern face of the Côtes Lorraines, commanding all the approaches from the Woëvre Plain, while the others are on the western slope of the Côtes and cover the crossings over the Meuse; the left rests on Verdun. There is no doubt that these form a very real obstacle to any German invasion.

Two gaps (*trouées*) have been left on purpose—one between the north and south section and the other between the north section and the defences against Belgium on the N.E. Frontier. These defences consist only of the two antiquated fortresses Longwy and Montmedy, and the old forts (*Sperren*) of Les Aynelles, Charlemont and Hirson. These gaps are not wide enough to let any considerable force through, and there are no railways to help a force. Should a German army venture on these gaps it would be in great danger of being attacked on both flanks by French armies who can move in safety behind the *rideaux defensifs* and, thanks to their network of railways, move rapidly from one side to another. Until a few years ago the gaps were considered to be the key (*clou*) of the whole scheme. It was considered that even in the event of the

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first line being broken, there was still sufficient protection, as the second line has some very good points behind which the army could rally. Latterly in military circles there has been an opinion that the gap north of Verdun is not sufficiently protected against an attack made either simultaneously with, or immediately after the declaration of war. Such an unexpected incursion would have the gravest possible results on the mobilization. The possibility of such an *attaque brusquée* is taken by several military writers (notably General Maitrot) to point out the urgent necessity of closing the above gaps. To emphasize this necessity on the French nation, the most impossible assertions are made, which are by way of showing the absolute certainty of this *attaque brusquée*. Senator Bérenger's achievement in *The Matin* is an instance of this.

The " Old Camp " at Wasserliesch was used by General Crépug as a camp, and hence the name. Bérenger makes a *camp de concentration* out of this and shortly afterwards describes it as a *camp retranché*. A winter exercise which is said to have taken place in February is the innocent cause of the reputed origin of a new German fortress.

The fear that the enlargement of Ehrang Station is being done with offensive motives is more comprehensible. The necessity for this enlargement can be found nearer home. Ehrang is the centre of three important railway lines (Cologne-Gerolstein-Treves ; Coblenz-Treves ; Saarburg-Metz-Bittburg-Treves), and with the increasing development of the Rhine province large stations with many platforms and lines of metals are necessary to cope with the increasing traffic. For the same reason it is not surprising that there are eight large bridges over the Moselle in the sixty kilometres between Treves and Diedenhofen, and that they have not been built to facilitate a rapid crossing of the Moselle by a German invading army.

M. Bérenger's fears that the Luxembourg railways may be used are also groundless, as conditions have been made that they cannot be used by the German military authorities on mobilization. The French people must not take the revelations about Luxembourg in *The Matin* too seriously. But still we cannot blame the French for their fear of an *attaque brusquée*. The warning sounds to them like the " Hannibal ante portas " of old.

It is of interest to note, however, that the French themselves refute Senator Bérenger's alarmist article. The *France Militaire*, which cannot be accused of an undue love for the Germans, has an article pointing out that Bérenger has based his announcements on false premises. They point out quite correctly that the " Old Camp " at Treves—the manœuvre ground of Elfenborn is meant—can be of no offensive use. Even if the Germans did want to take the offensive through Luxembourg, they would not concentrate 250,000 men in one camp, who would be separated at the beginning of the advance. The " Old Camp " can only be used for defensive purposes during the advance. In the same way the newly-made railway centres in large garrisons or fortified places only serve for defensive purposes in order to send the covering troops well forward. The newly built bridges over the Moselle undoubtedly help the crossing of that river, but there are still several marches to the French frontier, and before these can be made the

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French can complete their mobilization. So there can be no question of a surprise. It is a physical impossibility to move an army of 250,000 men to the French frontier on one through railway line such as the Luxembourg railway. German military writers have often pointed this out, but hitherto unfortunately in vain. Hence it is significant that so distinguished a paper as the *France Militaire* should have taken it up.

REVUE MILITAIRE SUISSE.

June, 1913.

THE USE OF NEUTRALITY IN OUR FOREIGN POLICY.

By Cuno Hofer, First Lieut. of Cavalry.—The author regrets that constant and absolute neutrality should be one of the fixed principles of the Swiss Constitution. Such an attitude should be one of foreign policy only, to be assumed or not as circumstances demand at the time, and not an inviolable rule.

But in the case of Switzerland neutrality has become such a maxim that an independent foreign policy seems impossible, a state of affairs somewhat derogatory to the country. Swiss neutrality is, however, not like that of Belgium, guaranteed by the European Powers, but only recognized, and there is no reason why it should be adhered to if such a course were prejudicial to the country. This point of view is argued out from tradition and history, and is continued in the July and August numbers.

FIELD HOWITZERS.

By Colonel P. van Berchem.—An examination of the characteristics, organization and employment of field howitzers by other nations, written in anticipation of the early introduction of these weapons into the Swiss Army. In order that artillery officers may not be behindhand on their arrival, he recommends the study of a work by Capt. H. Friederich, "Die Taktische Verwendung der schweren Artillerie."

THE ATTACK AND DEFENCE OF FORTIFIED POSITIONS.

By L.—The writer draws attention to the fact that most wars in Switzerland must sooner or later develop into the attack and defence of fortified positions. He is of opinion that such warfare is insufficiently studied and practised, especially by the intermediate ranks such as commanders of battalions, groups, regiments, and batteries. He considers that the reason for this is, perhaps, the difficulty of reconciling the various books of regulations, which, published at different dates from 1904 to 1912, do not altogether agree with each other. His article is written with a view to diminishing this apparent disagreement. He considers that the attack of a fortified position will require at the least 36 hours. During the first day the foreground should be swept clear of the enemy, during the night the artillery and infantry will be methodically deployed, while on the next day, if the enemy has been sufficiently shaken, the assault may be delivered, but as a rule this period will be insufficient.

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July, 1913.

FROM KIRK KILISSEH TO LULE BURGAS.

By A.—This is a fairly detailed account of the occurrences from the 24th October to the 3rd November, and includes an account of the Battle of Lule Burgas. Only the movements of the larger units (regiments) are chronicled, but the article is interesting, and gives a very good general idea of the character of the fighting and of the country over which the operations extended. It is accompanied by a map.

ARTILLERY IN WAR.

By Commandant X.—An examination into the ideas which seem to prevail in France as regards the tactical employment of artillery in the battle of encounter, which it is considered will be the most probable form of engagement, considering the feeling on either bank of the Rhine.

The new *Artillery Regulations* of 1910 give the latest official ideas on the employment of artillery, but the compilers seem hardly to have expressed themselves with desirable clearness. They come into collision with those ideas of which General Percin is the most ardent advocate. Theorists consider that the advent of rapid fire and shields have rendered all the old ideas out of date, and that the artillery duel will no longer take place. That concentration of fire, besides being technically unrealizable, is now perfectly useless, rapidity of fire takes its place. Hence it is deduced that the number of batteries to bring into action does not depend on the nature of the objective but on the extent of front, whence the simple rule, one battery per 200 metres. Batteries not brought into action under this rule are referred to not as "in reserve" but as "disposable." Again it is considered that batteries can better support the infantry if distributed along the front; some would even distribute the guns. This was all very well against guns of merely accelerated fire, but all nations now use rapid fire and masked positions. On one point, however, all are agreed, and that is that infantry must be given all possible support by artillery.

The great point insisted upon in the regulations is the necessity for being in position before the enemy. Often, especially with important advanced guards, the guns of the main body may be sent on ahead of the infantry under the advanced guard only. General Percin holds that the infantry will always begin the attack unsupported by artillery, and will only ask for guns when they find themselves checked, but this is to fight with one arm against two. Elsewhere the General writes: "The regulations ought not to insist upon priority of position, as it leads to artillery taking position with no definite object, independently of the needs of the infantry." But this will not be the case, the guns should be ready to fire before those of the enemy, and to support the infantry from the outset. General Davignon rightly says that the first object of the artillery should be to relieve the infantry from the pressure of the enemy's guns, and secondly to support the infantry by detailing batteries to assist them directly by fire. The latest corrections to the German Regulations leave no doubt as to their insistence on first smashing the enemy's artillery; they would even use large calibre guns.

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It is doubtful whether any artillery would long remain inactive, each would seek to destroy the other prior to supporting their own infantry. It has been stated that under present conditions artillery cannot destroy, but only neutralize, the opposing artillery, surely a too modest conception. The regulations insist on destruction. It is too much to believe that the sole result of recent improvements is to leave the two artilleries powerless against each other. Opposing batteries both in masked positions and firing only shrapnel will do each other little harm, but in battle such positions cannot be counted upon. To reach dead ground it may be necessary to take up positions more or less in the open, and again, a position masked in one direction may be open in another, or exposed to enfilade, if not reverse, fire. Many batteries may be defiladed from view but still capable of destruction, especially by high explosive shell, the number of which carried in the field tends to increase.

Again, since 1910 the aeroplane has arrived to extend the radius of vision of the artillery, and the side which wishes to win should not hesitate to engage from the outset with all available batteries, detailing for direct support of the infantry such as can be spared as the enemy's fire slackens. Partisans of neutralization claim that with their method batteries can be detailed from the commencement directly to support the infantry, and, as it is more economical, more batteries will be available to meet unexpected events. But that method will not wear out the enemy, and it is questionable whether the batteries would be available just when and where required by the infantry. On the other hand, if the enemy's artillery is destroyed, more and more batteries will be available to help the infantry right up to the final assault, when all will be available to pave the way to victory. It is often said that the artillery fight will start over and over again. This may be true with the neutralization method, but the results of destruction are definite and durable. This is the old artillery duel revived, but it is probable that no infantry attack can develop until one side has the advantage in artillery.

VISUAL SIGNALLING.

Means of communication in battle are insufficiently developed. Various methods of transmitting orders are mentioned in the new *F.S. Regulations*, the last of which is visual signalling, which, thoroughly practised in other armies, is little appreciated in the Swiss, or only considered of use in mountain warfare. That this is an error, is evidenced by the use made of visual signalling in South Africa by the British, and in the Far East by the Japanese, while the Russians took to it during the campaign. The practical impossibility of arranging a fan of telephones during the changing phases of an attack makes visual signalling of peculiar importance. The writer advocates the Morse system, though the Federal Council considers that a militia army has not the time to spend on the necessary training. Means are suggested for overcoming this difficulty, and a rapidity is hoped for of 4 or 5 words a minute, at 4 or 5 kilometres and 6 or 7 words at 1 kilometre or less.

The organization suggested is eight men per company, grouped in patrols of two men distributed to sections. Each group to carry red and white flags for signalling and six pieces of coloured cloth corres-

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ponding to the six battalions of a brigade. A mnemonic system for remembering the Morse alphabet is given. In sending by day both arms raised and carrying flags = a dash, one arm and flag = a dot. At night long and short flashes are given with a lamp. Dashes and dots are written down at the receiving end and then deciphered with the help of an ingenious key. Each letter is acknowledged by a dot if understood, and by a dash if not understood, and ends of words and messages are signalled by appropriate signs. The flags can be used by a man lying on his back.

August, 1913.

THE QUESTION OF OFFICERS.

This article criticizes, not altogether unfavourably, a pamphlet written by Capt. Bruno Zschokke, of the Engineers, in regard to the difficulty of obtaining officers suitable for filling the higher commands in an army mostly composed of militia, and suggesting remedies.—(*To be continued*).

ARTILLERY IN WAR.

By Commandant X. (*concluded*).—If the artillery duel is now, as formerly, the necessary prelude to every battle, it is no less the bounden duty of the artillery to support, at all hazards, the infantry during the successive phases of the combat. This requires co-operation, which can only be properly secured by the skilful dispositions of the G.O.C.-in-C. To split up the battle into small independent infantry engagements, supported by artillery detailed for the sole support of each, is fatal. The regulations make it clear that the enemy must be held all along the line by a minimum of troops, the principal effort being made against a selected point. This attack must be vigorously pushed home, and all available artillery must be prepared to participate in the final assault.

The artillery should be under the orders of a commander in close touch with his chief, who must also keep careful watch on the infantry advance, and of its effects on the enemy. Time is wasted if the infantry is depended upon to point out the objects they wish the artillery fire directed upon. The infantry advance will cause the enemy to show himself and afford targets for the artillery, unless he is himself determined to attack, in which case he must show himself to advance. The artillery commander must be ready, on his own initiative, to seize these fleeting opportunities. This refers to field artillery only.

The Germans claim that their long-range guns and howitzers can be used from the commencement of a battle, not only to engage the enemy's guns, but to fire on formed bodies of troops or columns on the march, and to cover the deployment of the field artillery when this has to be undertaken within range of the enemy's guns. The German 13-c.m. guns appear the best adapted for this purpose, but at 12 k.m. the angle of descent of its shell is 42 degrees, the probable error in height of burst 40 m., and the probable error in range 90 m., so that its effect on artillery in position is likely to be small. At short ranges, say up to 3,000 yards, the flat trajectory will leave a large dead angle, and most of the shrapnel bullets will fly harmlessly into space.

The Battle of Chatalja offers an example of the rational use of heavy guns. The opponents were separated by a wide valley, and their guns

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were out of range of each other and could only act against the infantry. On the whole the Balkan War does not furnish many arguments in favour of heavy guns. At Monastir the Turks could use their field guns after they had been bombarded for two days by the Servian heavy artillery, but this may have been due to causes at present unknown. It would be rash to say yet that long-range guns are a necessity. Fire is seldom required at over 7 or 8 k.m., and the latter is the limit of range of the 75-m.m. field gun. It would be better to improve this weapon by giving it a large vertical field of fire without the necessity for sinking the trail, and to have a smoke-producing compound in the shell to facilitate observation.

September, 1913.

THE QUESTION OF OFFICERS.

This article is concluded, and suggestions are made under which officers might find more favourable opportunities than exist at present for studying their military duties and fitting themselves for the higher commands.

FROM LULE BURGAS TO CHATALJA.

A clear general account of the Turkish retreat after their defeat at Lule Burgas, and of their occupation of the lines at Chatalja. Also of the movements of the Bulgarian armies during the same period, and of the principal features of the Battle of Chatalja. The result was a severe check to the Bulgarian arms, and it is not quite clear what General Dimitrieff's intention was in attacking as he did.

VISUAL SIGNALLING.

Capt. Friedrich makes some further suggestions on this subject. Instead of distinguishing the longs and shorts of the Morse alphabet in the way proposed by Lieut. Decolligny in the July number of the magazine, he would make dots and dashes with the flags, as is done in Germany. A scheme is put forward for the organization and training of signallers in each company of infantry. A rapidity of five to eight words a minute is anticipated, and hopes are expressed that a general system, suitable to the whole army, may shortly be introduced.

DIRIGIBLES IN THE FIELD.

By H.F.—The first real tests of the tactical employment of dirigibles were made in Tripoli. Two machines arrived in December, 1911, and made 91 ascents, gathering much topographical and tactical information. The aeronauts made a map of a large area of country on a scale of 1/40,000, and took many photographs showing the shape of the ground, roads, habitations, etc., which were of great use to the staff of the army. Some reconnaissances at a low altitude, with a telephotographic apparatus, showed trenches, camps and magazines.

The crew consisted of three officers and a mechanist. The results obtainable depended on several factors ; the altitude of flight, condition of the atmosphere, nature of ground and the nature of the objects sought for, the possibility of employing optical instruments, and the visual and intellectual abilities of the pilots. The altitude at first chosen was 900 metres, but this brought them under effective fire, and was raised to 1,000 metres for reconnaissances and 1,200 metres for offensive action.

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The atmospheric conditions were very favourable, the country was very open, and even isolated men could be clearly distinguished. 330 bombs were dropped; the results were not particularly satisfactory, but a fund of information was obtained on their employment and construction.

Several experiments were tried on termination of the campaign, but neither details nor results are described.

October, 1913.

THE MILITARY AID SENT BY GENEVA TO WILLMERGUE.

This is only of historical interest.

MANŒUVRES OF THE 2ND DIVISION.

These manœuvres took place between the 8th and 11th September. The events of each day are described and shortly criticized, but as no map is published are somewhat hard to follow. The criticisms are clear and appear to be very sound and instructive.

THE BATTLE OF CRESSIER.

By 'L.—In a recent article the writer summed up the principles of the attack and defence of fortified positions. In this article he develops these principles by describing an imaginary battle, choosing for his ground that shown in the "Fortification in the Field of Battle," exemplifying the defence of a position. The map is reproduced, and the scheme is carefully and scientifically worked out, and is instructive and well worth studying.

A.R.R.

RIVISTA DI ARTIGLIERIA E GENIO.

July—August, 1913.

TECHNICALITIES AND TACTICS FOR THE CROSSING OF RIVERS.

Under the above title, Colonel Martens, of the German Engineers, has published at Berlin a very interesting paper from which the following extracts are taken:—

The bridging of rivers in war is a work of the greatest importance, and is entrusted to the pioneers who are practised in times of peace, sometimes with regular bridging material and sometimes with improvised material. It is not, however, necessary to consider the matter only in a technical light; the greater difficulty presented in the crossing of rivers is the adaptation of the technical operations to the requirements of the tactical situation in front of an enemy prepared to defend the passage. Only exercises of an absolutely practical character, similar to those required in true warfare and effected in union with the other arms, can give an idea of the difficulties presented in crossing a river in the presence of an enemy.

The bridging of rivers within the radius of the enemy's operations is not an essentially technical duty for the pioneers, but all the arms should take their turn; and it should be taught that the technical skill of the pioneers and their efforts for the completion of their special duty are not sufficient, but that success can only be gained by the satisfactory co-operation of the various commanders, and by the vigorous action of all the troops. The experience drawn from military history and from

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peace manœuvres proves that tactics and technical considerations should follow the same lines, but unfortunately there is often a tendency for the latter to prevail in the presence of the enemy; doubtless technical details must be considered, and in many cases must influence a decision, but this should not be given too prominent a place.

Now, in the passage of rivers, moral factors as well as the varying proximity of the war, must be considered; the real site of the bridge can be kept a secret, and greater efforts can be made in places where the enemy is not prepared to meet them. The most difficult examples of crossing a river should frequently be practised for instruction, but it must not be assumed that these could always be adopted in the face of the enemy. This idea, however, is not supported by the regulations. "Instructions for Pontooneers" (*Pontonier-Vorschrift*, 1911) accentuates the importance of celerity and forcible action (*viva forza*) in the passage of a river. In the new "Instruction in Fieldworks for all Arms" (*Feldpionierdienst aller Waffen*) the view is expressed as follows:—

"Whenever it is intended to occupy a river-bank before the enemy and to defend it, it is especially necessary to profit by the advantage that would thus be obtained, and to effect a surprise by a crossing with unattached boats or rafts. A river can be forced when, by a preponderating fire, the adversary can be prevented from defending the places of passage. Such a proceeding presents very great chances of success against an enemy weakened by preceding combats, but should not require long preparation nor be attempted at night, as it must be carried out with promptness and energy. If a commander is confronted by a river which impedes his operation, and which must be quickly crossed, this can only be effected when the enemy is at a distance."

In cases where an energetic opposition on the part of the enemy is foreseen, technical methods and tactics should be combined so as to ensure the success of the attempt, however difficult it may prove. The responsibility of the tactical dispositions for the actual crossing lies with the commander of the troops; the technical arrangements, only, are under an officer of superior rank in the corps of pioneers.

The pioneers are especially instructed in technical work in connection with the passage of rivers. Although their energy and efficiency is beyond question, their physical powers are not unlimited, and not only the troops themselves, but also the commanding officers of the pioneer may find themselves overwhelmed by the mass of duties imposed upon them. A commander would commit a grave error should he not arrange to have at his disposal the necessary force of pioneers. It should be the duty of officers of pioneers of superior rank to represent at an opportune time, and with firmness, any insufficiency in the number of technical troops, and to procure reinforcements from other troops should the number of pioneers assigned be insufficient. Referring to the employment of pioneers at the Battle of Woerth, special mention is made of the delay caused in the construction of bridges over the Sauer.

The selection of the commanding officer of the pioneers, attached to an army corps, is a matter of great importance. This officer should be possessed of special energy of character, so that in critical moments of a battle he may be able to represent resolutely to the officers in high command, the necessity or otherwise of bridging a river at an opportune time.

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It is always of great importance to have the largest possible quantity of regular bridging material ready at any moment, otherwise it is impossible to construct rapidly and without special preparation, bridges hat will satisfy all the conditions of war. Improvised bridges over small rivers take a long time to construct, as the provision of the materials for construction is a matter of difficulty.

The author, after the general considerations referred to above, observes that the scope of his work does not touch upon the strategic view of the passage of rivers by bridging in relation to the great operations of war. He limits himself to the more restricted field of the relations between tactics and technicalities in cases of offensive operations, involving the passage of rivers over which there are no permanent bridges.

The author in the new "Instruction in Fieldworks," for all the arms, considers four distinct cases :—

1st. When the construction of a bridge is at a long distance from the radius of the enemy's operations, and he cannot interfere with the operation in strong force and can only molest patrols and small detachments.

2nd. When the enemy, owing to the rapid execution of the work, has not been able to take measures for the security of the place of crossing ; in such a case it is necessary to seize the other bank of the river and to take advantage of the ground thus acquired.

3rd. When the enemy in weak force opposes the position by fire action and seeks to draw the attack to the river ; in this case the passage must be attempted *di viva forza.*

4th. When the enemy has organized a more or less extended surveillance over a long course of the river and can intervene with a strong force against the attack; the assailants then, after accurate preparation, endeavour to draw away the greater part of the enemy by a rapid attack ensuring the possession of the opposite bank ; at the same time, if necessary, an active demonstration is made against the enemy's front.

The second part treats diffusively of rivers in general, and considers the various eventualities presented in time of war, with many practical examples.

The third part is dedicated to a valuable study recently published in Germany by General v. Falkenhausen on "The Manœuvring of Modern Armies in Great Masses." This treats of the operations of what may be called the great armies of the future. The author refers to the example of the Battles of Leuthen, where Frederick the Great, with weak forces, by means of an energetic action on the flanks, obtained a victory over an adversary with greatly superior numbers. The question is discussed in an able and exhaustive manner with abundance of dates and details, many of which refer to the passage of river.

The fourth part refers to the defence of rivers and treats practically of the defence of the Oder.

Colonel Mertens's work closes with two appendices. The first may be called a photographic illustration of the matter contained in the "Instruction in Fieldworks for all Arms" as far as it relates to the rapid passage of rivers. The second appendix treats of the bridging equipment assigned to various armies, and particularly to the German Army.

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POCKET-BOOK OF USEFUL FORMULÆ AND MEMORANDA FOR CIVIL, MECHANICAL AND ELECTRICAL ENGINEERS. By Sir Guilford Molesworth, K.C.I.E., and H. B. Molesworth. 27th edition. With an Electrical Supplement by W. H. Molesworth. 5s. net. E. & F. N. Spon, Ltd., 57, Haymarket, S.W 1913.

BUILDING SUPERVISION. By Geo. W. Grey. 2s. 6d. net. E. & F. N Spon, 57, Haymarket, S.W. 1913.

DYNAMO LIGHTING FOR MOTOR CARS. By M. A. Codd. 128 illustrations. 2s. 6d. net. E. & F. N. Spon, 57, Haymarket, S.W. 1913.

PORTLAND CEMENT: ITS MANUFACTURE, TESTING AND USE. By D. B. Butler. 16s. net. E. & F. N. Spon, 57, Haymarket, S.W. 1913.

GENERAL SIR ALEX. TAYLOR, G.C.B., R.E.: HIS TIMES, HIS FRIENDS AND HIS WORKS. By Alicia Cameron Taylor. 2 vols. 25s. net. Williams & Norgate, Henrietta Street, W.C.

PEMBA, THE SPICE ISLAND OF ZANZIBAR. By Capt. J. E. Craster, R.E. With 30 illustrations. Price 12s. 6d. T. Fisher Unwin, Adelphi Terrace, W.C. 1913.

THE FLAW IN OUR ARMOUR. By Major-General Sir W. G. Knox, K.C.B. With an Introduction by Field Marshal Earl Roberts. Price 1s. net. Herbert Jenkins, Ltd., Arundel Place, Haymarket, S.W. 1913.

LIST OF ANNUAL SUBSCRIPTIONS TO ENGLISH, COLONIAL AND FOREIGN NEWSPAPERS AND MAGAZINES. Wm. Dawson & Sons, Ltd., Bream's Buildings, London, E.C. 1914.

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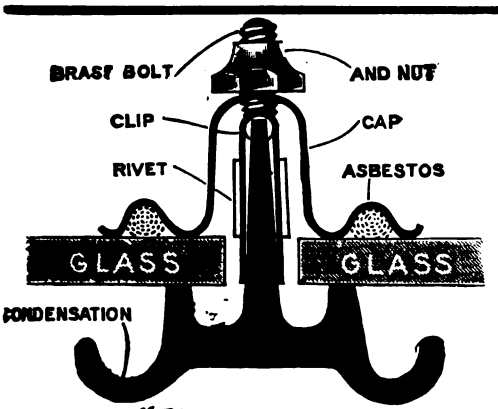

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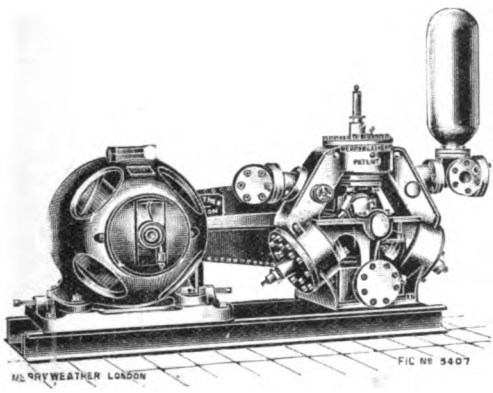

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